R E P O R T R E S U M E S

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AGRICULTURAL MECHANICS INSTRUCTION IN SECONDARY SCHOOLS IN MISSISSIPPI, THE LABORATORY-WORK AREA APPROACH.

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TO MEET THE NEEDS RESULTING FROM INCREASED FARM MECHANIZATION, AN INTENSIFIED AND EXPANDED CURRICULUM IN AGRICULTURAL MECHANICS HAS BEEN PROPOSED COVERING--(1) FARM MACHINERY, (2) FARM BUILDINGS, (3) ELECTRICITY, (4) WELDING, (5) CONCRETE AND MASONRY, (6) PLUMBING, (7) METAL WORKING, AND (8) TOOL FITTING. DISCUSSION OF EACH OF THESE AREAS INCLUDES CONTENT, SPECIFIC ACTIVITIES, REQUIRED EQUIPMENT AND SUPPLIES, AND DESIRED OUTCOMES OF THE PROGRAM. (JT)

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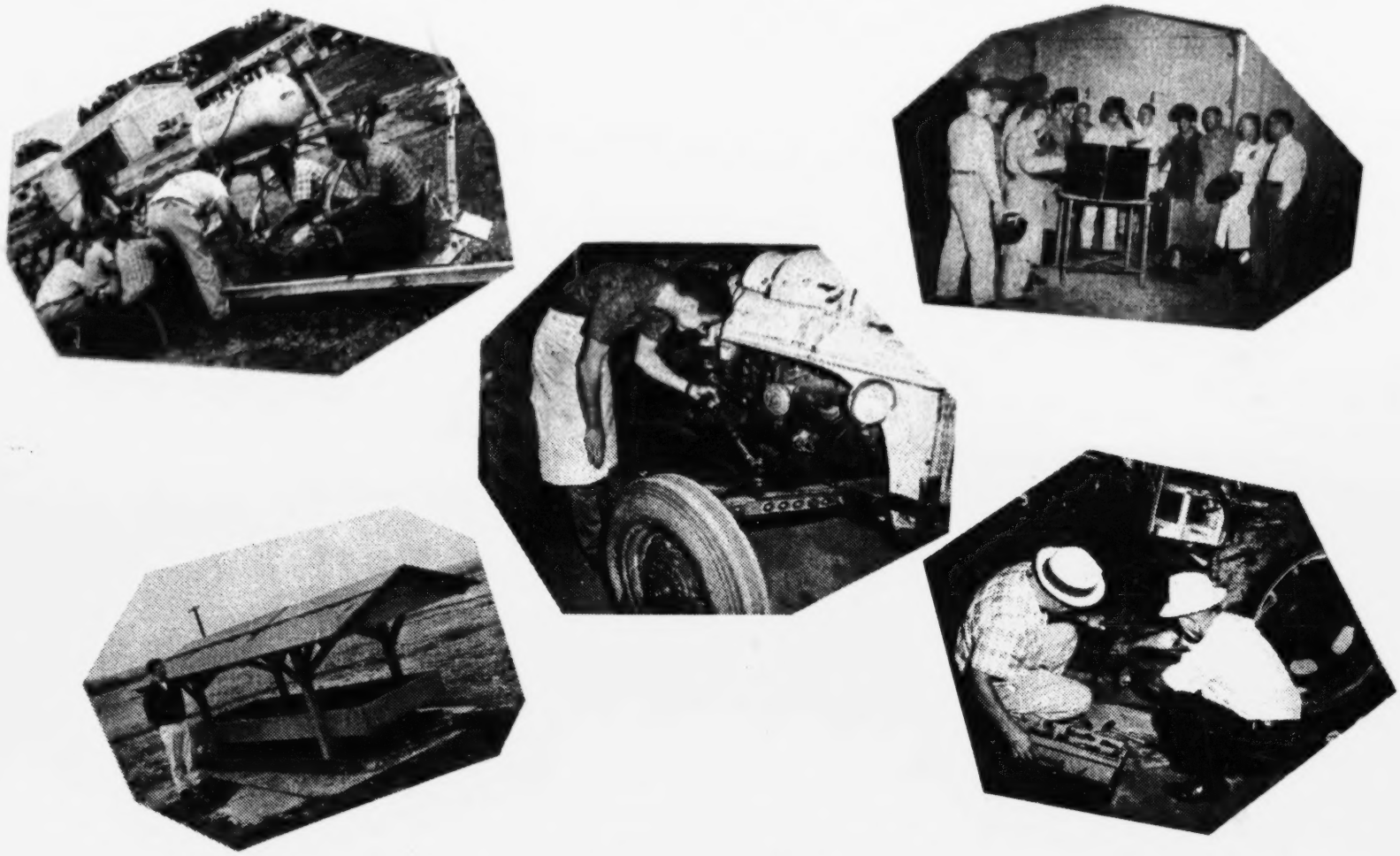
AGRICULTURAL MECHANICS INSTRUCTION IN SECONDARY SCHOOLS

Organization of Laboratory-Work Areas

A state approved new and more efficient approach to teaching agricultural mechanics in vocational agriculture departments in Mississippi.



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AGRICULTURAL MECHANICS INSTRUCTION IN SECONDARY SCHOOLS IN MISSISSIPPI

The Laboratory-Work Area Approach

A state approved new and more efficient approach to teaching agricultural mechanics in vocational agriculture departments in Mississippi

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FOREWORD

Capital investment in machinery, buildings, and other facilities and equipment on the modern farm has increased to the point where it, in many cases, exceeds all other investments in the farm business, including the land. The coming of mechanization and automation to the farm makes it mandatory that vo-ag instruction in agricultural mechanics be expanded and intensified.

Because of location and circumstances on many farms, it is often difficult, or impossible, to secure emergency repairs and maintenance at the time needed on the complex machinery and facilities used by modern farmers. Hence, it is essential that farm operators and farm workers have knowledge and skills in the selection, operation, maintenance, and repairs of these machines and facilities.

A factor often overlooked is that the basic knowledge and skills acquired in agricultural mechanics parallel those essential in many industries. Therefore, knowledge and skills acquired in agricultural-mechanics instruction would be invaluable to those going into industrial employment. Dr. Levenway, in his study on the Needs for Vocational and Technical Education, recognized a need for present-and-prospective-farmer training when he stated that there is an increasing need for improving the technical skills of these groups. He also stated that there is a real necessity for continuing to provide the semi-skill training now available in most vocational agriculture farm shops.

Present vocational education legislation has expanded the areas of instruction in vocational agriculture to include related occupations. Hence, instruction will be broader in scope and reaching into skill training in areas other than production agriculture. The new concept in agricultural-mechanics instruction includes a broadened field of basic knowledge and skills.

It is the object of the expanded and intensified program of agricultural mechanics to give each student instruction in the basic principles and skills in the following seven subject-matter areas:

1. Agricultural construction (carpentry, concrete and concrete masonry, preserving and fencing).
2. Agricultural maintenance and repair work (cold-metal work, tool fitting, arc welding, gas welding, and forge work).
3. Electricity and electric motors.
4. Water systems (supply and disposal).
5. Tractors, auxiliary engines, and trucks (principles of operation, preventive maintenance, simple repairs, etc.).
6. Agricultural machinery (land preparation, harvesting, fertilizer distributors, planting, cultivating, dusting, and spraying).
7. Soil and water technology (engineering phases).

To provide organization in the work areas of the farm shop, and to facilitate more effective instruction in the basic skills necessary for the modern farm worker to perform his job effectively, the farm shops in the vocational agriculture departments must be reorganized into laboratory-work areas such as are suggested in Figure 1. In addition, these laboratory-work areas must be adequately supplied with tools, equipment, and supplies to give the student practice in the application of the basic principles being studied.

The laboratory-work areas have been designed and arranged to obtain the maximum use of floor space and maximum efficiency in instruction. Each laboratory-work area designated in the floor plan, Figure 1, has adequate floor space; and when the tools, equipment, supplies, and storage cabinets as suggested in this publication are provided, a maximum of six students may be taught effectively. Due to the nature of agricultural mechanics instruction, no more than twenty-four students should be enrolled in any one class.

This approach to teaching agricultural mechanics does not preclude that the vocational agriculture teacher would eliminate the supervised experience training carried on outside the classroom. Indeed, it is the supervised experiences outside the classroom that provide the most fertile and realistic application of what is learned in the laboratory-work areas.

Much time and thought has been given to this publication by state staffs, graduate students, and vocational agriculture teachers. The suggested organization, tools, equipment, and material lists are believed to be the minimum for effective instruction.

Acknowledgement is given to W. T. Taylor, District Supervisor, Vocational Agriculture, for furnishing the photographs and offering many valuable suggestions used in this publication. Also, acknowledgement is given to L. P. Jacks, Subject Matter Specialist, and J. R. Hamilton, Professor of Agricultural Education, for helping put the manuscript in final form for reproduction.

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TABLE OF CONTENTS

Area		Page
I.	Farm Power and Machinery	1
II.	Farm Building and Structures (Carpentry)	15
III.	Electricity	21
IV.	Welding	25
V.	Concrete and Masonry	31
VI.	Plumbing	37
VII.	Metal (Hot, Cold, Sheet)	45
VIII.	Tool Fitting	49

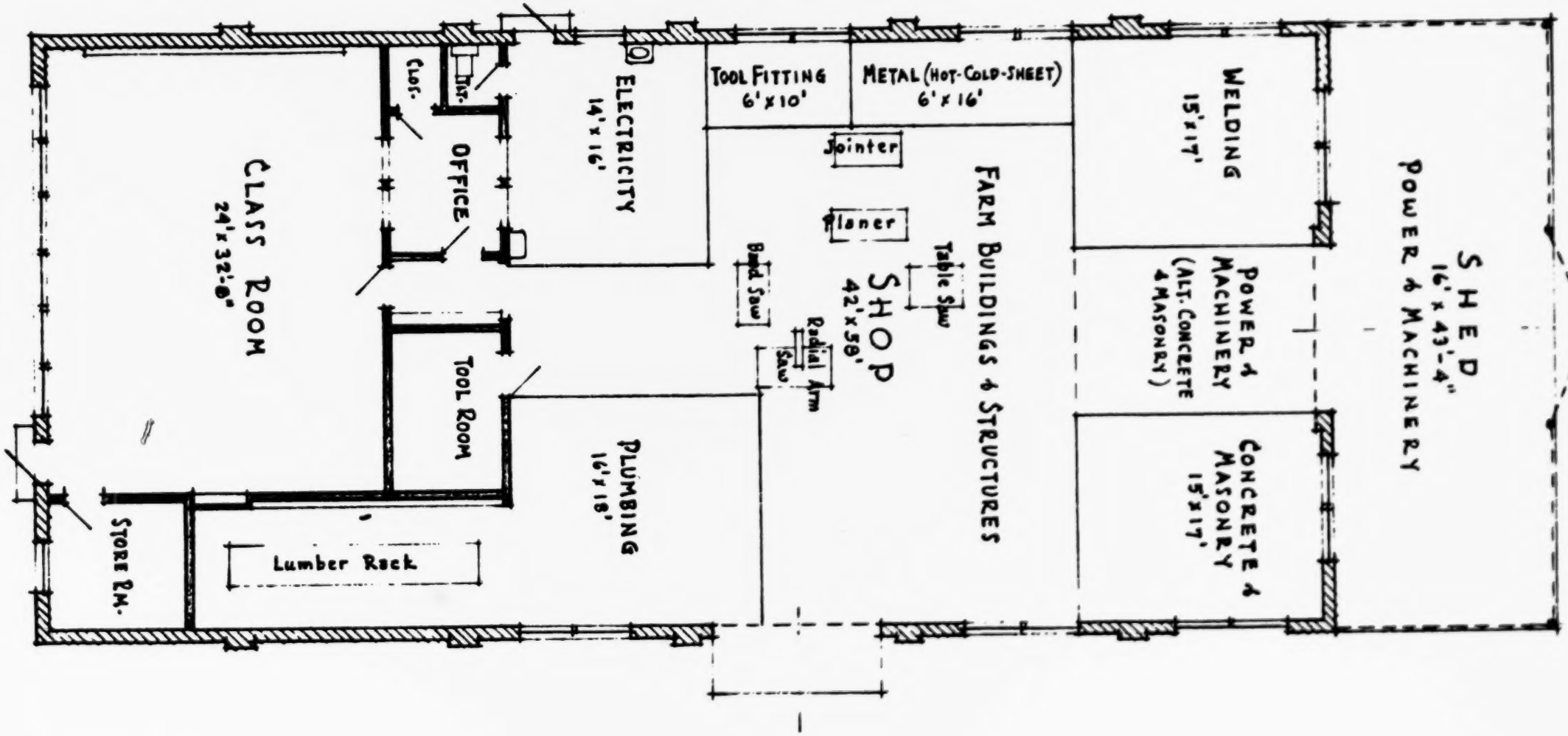


Figure 1 - Area designations agriculture-laboratory building plan no. VAG-9 State Department of Education, Jackson, Mississippi 9/10/63

AREA I. FARM POWER AND MACHINERY

A. Scope of Instructional Content

The selection, servicing, operation, adjustment, preventive maintenance and minor repairs to farm motors, tractors, trucks, and various farm implements.

B. Specific Activities to Be Performed to Develop Skills

TRACTOR AND POWER UNITS

General

1. Using operator's manual
2. Checking engine compression
3. Checking valve clearance
4. Adjusting valves

Fuel System

1. Servicing air cleaner
2. Cleaning and adjusting carburetor
3. Cleaning sediment bowl
4. Checking fuel lines

Lubrication

1. Flushing crankcase
2. Servicing oil filter
3. Selecting lubricants
4. Servicing differential and transmission
5. Servicing front and rear wheel bearings
6. Servicing pressure-type grease fittings

Cooling System

1. Flushing radiator
2. Adjusting fan belt
3. Selecting coolant
4. Checking and repairing leaks
5. Cleaning grill and exterior parts of radiator
6. Checking thermostat

Electrical System

1. Timing distributor
2. Timing magneto

3. Servicing battery
4. Cleaning and adjusting spark plugs
5. Checking and adjusting breaker points
6. Checking and repairing lighting system

Hydraulic System

1. Servicing system

Traction System

1. Repairing flats
2. Checking tire slippage
3. Inflating with air and water
4. Adjusting wheel spacing
5. Adjusting wheel lugs

Clutch

1. Adjusting and/or replacing clutch or parts

Brakes

1. Adjusting and/or replacing brakes or parts

Other Operations

1. Cleaning tractor
2. Painting tractor
3. Tightening -- general
4. Repairing or replacing broken or worn parts
5. Storing tractor -- "winterizing"
6. "Trouble-shooting"

AGRICULTURAL MACHINERY

Land Preparation

1. Study of the operator's manual
   a. Kinds and weights of lubricants to use
   b. Frequency and manner of lubrication
   c. Inflation and care of tires
   d. Safety features and operating practices
   e. Proper adjustment of equipment and hitch members

2. Identifying types of land preparation equipment and their parts
   a. Trailer-hitch moldboard plows
   b. Mounted tractor-operated moldboard and disk plows
   c. Two-way moldboard plows

d. Multiple-bottom plows
e. Multiple-disk plows
f. Cutting and pulverizing disks
g. Stalk cutters
h. Harrows
i. Sub-soiling equipment

3. Selecting and using land preparation equipment
   a. Type of soil and condition of soil
   b. Size of operation
   c. Cost
   d. Power available
   e. Advantages and disadvantages
   f. Service and maintenance

4. Selecting and adjusting colters, jointers, and scrapers
   a. Type of soil and condition of soil
   b. Trash or crop residue
   c. Depth to operate
   d. Determining furrow slice roll

5. Operating land preparation equipment correctly and safely
   a. Condition of soil and field
   b. Speed
   c. Starting and stopping
   d. Making turns
   e. Hitching and un-hitching
   f. Opening lands and finishing lands
   g. Making field adjustments
   h. Safety features of equipment
   i. Safety measures to be observed by operator

6. Servicing land preparation equipment
   a. Frames and beams
   b. Wheels
   c. Lifts and levers
   d. Gauges and adjusting devices
   e. Lubrication
      (1) Oils
      (2) Greases
   f. Tightening bolts, etc.
   g. Removing and replacing broken parts
   h. Making minor repairs - welding, etc.
   i. Sharpening
   j. Storage

Planting

1. Study of operator's manual
   a. Kind and weights of lubricants to use
   b. Frequency and manner of lubrication
   c. Inflation and care of tires
   d. Safety features and operating practices
   e. Proper adjustment of equipment and hitch members

2. Identifying types of planting equipment and their parts
   a. Grain drillers
   b. Corn planters
   c. Cotton planters
   d. Broadcast seeders
   e. Plant-setting machines
   f. Sod seeders
   g. Fertilizing attachments

3. Selecting and using planting equipment
   a. Type and condition of soil
   b. Size of operation
   c. Cost
   d. Power available
   e. Advantages and disadvantages
   f. Service and maintenance

4. Selecting and adjusting planting equipment
   a. Plates
   b. Driver sprockets
   c. Tension on drive chain
   d. Packer wheel spring
   e. Depth gauge
   f. Row width
   g. Furrow openers
   h. Fertilizer attachments

5. Operating planting equipment correctly and safely
   a. Condition of soil
   b. Speed
   c. Starting and stopping
   d. Making turns
   e. Hitching and un-hitching
   f. Making field adjustments
   g. Safety features of equipment
   h. Safety features to be observed by operator

6. Servicing planting equipment
   a. Frames and beams
   b. Wheels
   c. Lifts and levers
   d. Gauges and adjusting mechanism
   e. Lubrication
      (1) Oil
      (2) Grease
   f. Removing and replacing broken parts
   g. Tightening bolts, chains, sprockets, wheels, etc.
   h. Making minor repairs - welding, etc.
   i. Sharpening
   j. Storage

Cultivating

1. Study of operator's manual
   a. Kind and weights of lubricants to use
   b. Frequency and manner of lubrication

c. Inflation and care of tires
d. Safety features and operating practices
e. Proper adjustments of equipment and hitch members

2. Identifying types of cultivating equipment and their parts
   a. One-row cultivator
   b. Two-row cultivator
   c. Four-row cultivator
   d. Lister cultivator
   e. Weeder or weeder mulcher
   f. Chemical weeders
   g. Flame weeder
   h. Plant blocker
   i. Rotary chopper
   j. Rotary hoe

3. Selecting and using cultivating equipment
   a. Type and condition of soil
   b. Size of operation
   c. Cost
   d. Power available
   e. Advantage and disadvantages
   f. Service and maintenance

4. Selecting and adjusting cultivating equipment
   a. Spring trips
   b. Shovels, sweeps, disks, hoes, and knives - pitch
   c. Shovels, sweeps, disks, hoes, and knives - arrangement
   d. Gang adjustment
   e. Shank spacing - row width
   f. Shields or fender guards
   g. Roller guide
   h. Spring tooth attachments
   i. Disk attachments
   j. Fertilizer attachments
   k. Depth regulator and draft control
   l. Hydraulic lift raker

5. Operating cultivating equipment correctly and safely
   a. Condition of soil
   b. Speed
   c. Starting and stopping
   d. Making turns
   e. Hitching and un-hitching
   f. Making field adjustments
   g. Safety features of equipment
   h. Safety features to be observed by operator

6. Servicing cultivating equipment
   a. Wheels
   b. Axles
   c. Frames and beams
   d. Seats
   e. Gang lever
   f. Trip
   g. Sweeps, shovels, disks, hoes, and knives
   h. Hydraulic lift system

i. Lifting springs
j. Depth regulator and draft control
k. Removing and replacing broken parts
l. Tightening bolts, braces, couplings, and other fasteners
m. Making minor repairs -- painting, welding, etc.
n. Sharpening
o. Lubrication
   (1) Oil
   (2) Grease
p. Storage

Harvesting

1. Study of operator's manual
   a. Kind and weights of lubricants to use
   b. Frequency and manner of lubrication
   c. Inflation and care of tires
   d. Safety features and operating practices
   e. Proper adjustments of equipment and hitch members

2. Identifying types of harvesting equipment and their parts
   a. Mowers
   b. Rakes
   c. Baler
   d. Loaders
   e. Stackers
   f. Hay choppers
   g. Headers
   h. Grain binders
   i. Combine harvester-thrasher
   j. Conveyors and elevators -- portable
   k. Forage binders
   l. Ensilage cutters
   m. Field ensilage harvesters
   n. Ensilage blowers
   o. Corn pickers
   p. Cut-off corn harvesters
   q. Field corn shellers
   r. Cotton strippers
   s. Cotton pickers
   t. Others -- specialized crop harvesting equipment

3. Selecting and using harvesting equipment
   a. Type and condition of soil
   b. Size of operation
   c. Cost
   d. Power available
   e. Advantages and disadvantages
   f. Service and maintenance

4. Selecting and adjusting harvesting equipment
   a. Mowers
      (1) Aligning cutter-bar
      (2) Knife clips or holders
      (3) Wearing plates

(4) Tilting lever
(5) Ledger plates
(6) Side-draft control
(7) Cutter-bar height and lead
(8) Ground speed
(9) Tension of V-belts

b. Rakes
(1) Reel height adjustment
(2) Leveling reel
(3) Pitch of teeth
(4) Spacing of teeth
(5) Tie bar
(6) Tension
(7) Lift lever
(8) Ground speed

c. Balers
(1) Leveling fore and aft
(2) Height adjustment on pick-up
(3) Hitching to insure correct trailing over windrow
(4) Adjusting strokes per minute
(5) Baler head adjustment for slicing action
(6) Tension adjustment on twine or wire from carrier to knotter
(7) Bale weight adjustment
(8) Knotter
(9) Bale length
(10) Ground speed

d. Grain and forage binders
(1) Cutting unit
(2) Conveyor or feeding unit
(3) Binder deck unit
(4) Binder and tying unit
(5) Packer arms
(6) Trip-hook and trip-dog
(7) Twine-tension roller and slack-twine lever
(8) Binding and tying assembly
(9) Carrying and dumping unit
(10) Ground speed

e. Combine harvester-thrasher
(1) Making moisture test of crops to be harvested
(2) Ground speed
(3) Cutter-bar height
(4) Cylinder speed
(5) Reel speed
(6) Concave bar adjustment
(7) Selecting concaves for various grains
(8) Chopper adjustment
(9) Air blast

f. Ensilage cutters
(1) Frame and power-transmission unit
(2) Conveyor unit
(3) Feeding unit
(4) Cutting unit

(5) Blower and elevating unit
(6) Leveling fore and aft
(7) Cutter and blower speed
(8) Chain idler adjustment
(9) Ground speed

g. Field ensilage harvester
(On this equipment the adjustments and operation are the same as the gathering arms and stalk-cutting mechanism given for corn binder, while the ensilage-cutter operation is applicable to the silage-cutting mechanism.)

h. Corn pickers
(1) Frame and power transmission unit
(2) Snapping rolls
(3) Gatherers
(4) Husking rolls
(5) Slip clutch
(6) Fan blast
(7) Elevator

i. Cut-off corn harvester
(Same operating instructions as for corn binder-cutting mechanism apply to the cutting mechanism of this machine. The corn-picker instructions relative to snapping and husking are also applicable to the cut-off corn harvester. The shredder knives and blower are similar to the ensilage cutter husker-shredder.)

j. Cotton pickers
(1) Frame and power transmission unit
(2) Picker drum speed
(3) Doffer clearance adjustment
(4) Picker spindles and bars
(5) Spindle moisteners
(6) Picker bar pivot
(7) Drum box height
(8) Slip clutch
(9) Plant lifters
(10) Moistening system
(11) Mechanical oilers
(12) Vacuum and air delivery system
(13) Balancing springs
(14) Belts, drives, and chains
(15) Basket
(16) Ground speed

5. Operating harvesting equipment correctly and safely
a. Condition of soil
b. Condition of crops to be harvested -- maturity, moisture content, etc.
c. Speed
d. Starting and stopping
e. Making turns
f. Hitching and un-hitching
g. Making field adjustments
h. Safety features of equipment
i. Safety features to be observed by operator

6. Servicing harvesting equipment
   a. Wheels
   b. Axles
   c. Frames and beams
   d. Levers
   e. Hydraulic lift system
   f. Power transmission unit
   g. Chains, sprockets, drives, and belts
   h. Gauges and adjusting devices
   i. Replacing broken and worn parts
   j. Tightening bolts and studs
   k. Making minor repairs -- welding, etc.
   l. Lubrication
      (1) Oil
      (2) Grease
   m. Cleaning, painting, and storing

Spraying and Dusting

1. Study of operator's manual
   a. Frequency and manner of lubrication
   b. Safety features and operating practices
   c. Proper adjustments of equipment and hitch members

2. Identifying types of spraying and dusting equipment and their parts
   (1) Premeergence
   (2) Postemergence
   (3) Lay-by
   (4) Boom
   (5) Boom jet
   (6) Fumigation
   (7) Knapsack
   (8) Hand
   (9) Hi-boy
   (10) Others

3. Selecting and using spraying and dusting equipment
   a. Size of operation
   b. Cost
   c. Power available
   d. Advantages and disadvantages
   e. Service and maintenance

4. Selecting and adjusting spraying and dusting equipment
   a. Nozzles
   b. Gauges and regulators
   c. Nozzle spacing
   d. Nozzle height
   e. Agitation
   f. Belts and pulleys
   g. PTO speed
   h. Shields
   i. Calibration
   j. Pumps
   k. Hose
   l. Regulators

5. Operating spraying and dusting equipment correctly and safely
   a. Speed
   b. Starting and stopping
   c. Making turns
   d. Mounting and dismounting
   e. Making field adjustments
   f. Safety features of equipment
   g. Safety measures to be observed by operator

6. Servicing spraying and dusting equipment
   a. Frames and beams
   b. Lifts and levers
   c. Gauges and regulators
   d. Lubrication
   e. Pumps
   f. Nozzles
   g. Hose
   h. Connections and fittings
   i. Strainers
   j. Belts and pulleys
   k. Tanks and hoppers
   l. Cleaning, painting, and storing

C. Tools and Equipment (Farm Power and Machinery)

Battery hydrometer 1

Brushes, wire -- hand, long handle 2

Cans
- Gasoline -- safety type, size optional. 1
- Solvent storage. 2

Cell tester 1

Cleaner
- Steam -- capacity 60 gallons water per hour. Fuel supply gas fired 190,000 Btu per hour. Natural gas standard, special LP and MFG gas. Operating pressure cleaning solution 60 to 90 lbs. as desired. Four gallon solution tank, cleaning gun with 25' hose, also 4 1/2 ft. length of acid resistant hose for use in de-scaling coil, 1/4 hp, 110-volt, 60-cycle a-c, single-phase electric motor. Complete unit.
  (Clayton-Kerrick, Steam Jenny or equal) 1

Compressor
- Air -- complete with 1 1/2-hp, single-phase or three-phase 60-cycle electric motor, 7.30 cfm displacement, 60 gal. tank with operating pressure up to 175 lbs. Complete with 50 ft. hose, air blow gun, and tire check.
  (Devilbiss or equal) 1

Creeper -- automobile 1

Gauges	
Air -- for tires	1
Compression	1
Ignition feeler -- .0015 to .040 graduations	1
Spark plug -- .022 to .040 graduations	1
Vacuum	1
Gun, Grease	
Lever type	1
Power type -- 1 1/2 to 2 lbs. grease capacity, pistol type, push button operation, designed to operate on pressure from air compressor which will deliver 7.30 cfm displacement. Complete with flexible hose, with pin type or snap-on fittings. (Campbell-Hausfeld No. A-40 or equal)	1
Gun, Paint	
Pressure -- complete with 1 qt. cup and nozzles. Commercial siphon type. To handle paints, lacquers and enamels. Gun to handle up to 11.4 cfm displacement. Complete with pressure regulator. Spray gun to operate from 1 1/2-hp air compressor with 60 gal. tank. (Binks No. 19 or equal)	1
Hammers	
Cross peen -- 2 lb. blacksmith	1
Ball peens -- 1 lb. and 2 lbs., one each	2
Hoists	
Built up "A" frame -- 3" pipe or tubing or "I" beam with casters, homemade	1
Chain -- capacity 1 to 2 tons	1
Ignition timing light -- combination 6 and 12 volt (Sun or equal)	1
Jack, hydraulic -- capacity 2 tons	1
Oil squirt can	2
Pliers	
Combination -- slip joint, side-cutting	2
Water pump	2
Vise grip -- 8"	2
Pullers	
Gear & wheel -- heavy duty	1
Gear -- small, 0" to 3"	1
Punches	
Aligning -- points 3/16", 1/4", 3/8", one each	3
Center, machinists -- diameter at top of tapered point 1/8", 7/32", one each	2
Pin, machinists -- 3/32", 1/8", 5/32", 3/16", 7/32", one each	5
Starter	2
Screw drivers	
Standard -- medium to large, assorted size	8
Phillip -- small to medium	4

Socket sets
- 3/8" drive -- 3/8" to 3/4" with extension, universal joint and speeder, set 1
- 1/2" drive -- 3/8" to 1 1/8" by 32nds, set complete 1
- 3/4" drive -- 1 1/8" to 2 1/4" by 32nds, set complete 1
- Deep -- 7 sockets 3/8" to 14/16", to be used with 1/2" ratchet. 1

Spark plug cleaner and tester (Champion or equal) 1

Stud setter or extractor 1

Tachometer -- contact wheel spinner. 1

Viscometer -- used for determining proper density of paints, lacquers and enamels (Mfg. by Sears, Roebuck & Co.) 1

Vise -- 6" machinists. 1

Wrenches
- Ignition -- 3 wrench set 1
- Torque or tension -- 1/2" drive, 0-150 foot pounds 1
- Adjustable, open-end -- 4", 8", 10", 12", one each. 4
- Combination box- & open-end -- 1/4" to 3/4" set by 16ths 1
- Monkey -- 18". 1
- Allen -- set 1

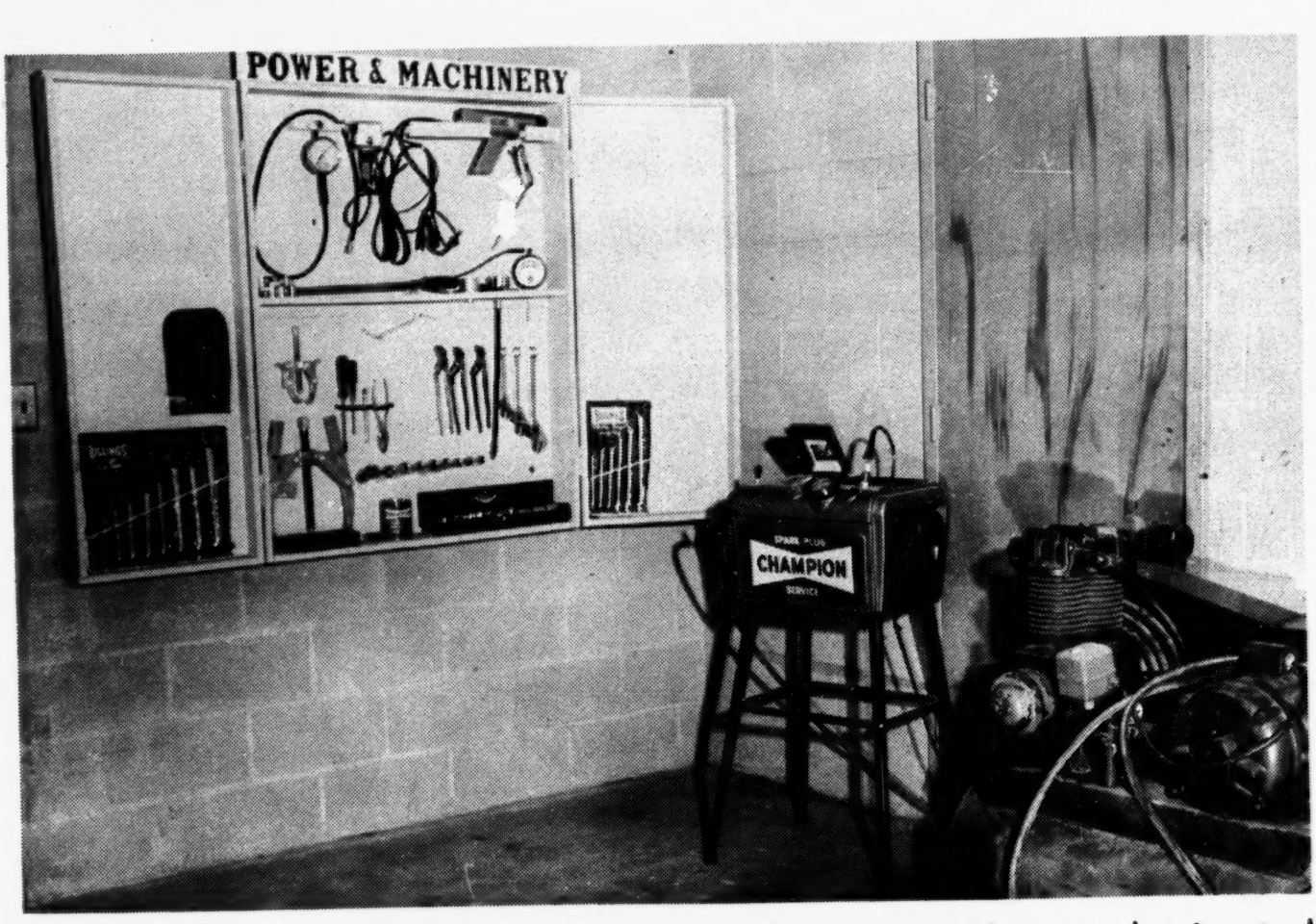


Figure 2 - A portion of a power-and-machinery laboratory work area, showing tool cabinet, spark plug cleaner-tester, and air compressor. This cabinet does not contain a complete set of tools needed for this area. (See tool list on page 10.) Cabinet size is: length 48 inches, width 36 inches, depth 10 inches.

D. Materials and Supplies (Farm Power and Machinery)

It is difficult to prepare a detailed comprehensive list for instruction in this area, due to the varied nature and scope of materials and supplies available. Sufficient amounts of these materials and supplies should be provided to give the skilled training needed: greases, oils, cleaning agent, wiping rags, spark plugs, ignition points, condensers, gaskets, gasket material, ignition wire, pressure caps, oil filters, air filter elements, brake fluid, various tubing material, decals, paint, steel wool, emery cloth, bolts, studs, screws, rivets, files, etc.

E. Outcomes

Primary outcome: An adequate supply of farm operators and farm workers who have a knowledge of the basic principles of farm power and power machinery; and who have skills in:

1. Selecting, operating, and performing preventive maintenance jobs on tractors and small engines.
2. Adjusting, operating, and performing preventive maintenance jobs on any type of machinery used on the modern farm.

Secondary outcomes:

1. A supply of workers who have had training in the basic principles of the operation of internal combustion engines, and who have basic skills in operating and maintaining these engines. In addition, these workers have a knowledge of operating, adjusting, and maintaining a variety of complex machinery and equipment. This knowledge and these skills are useful to the individual in entering a variety of off-farm occupations in farm equipment establishments and similar businesses.

2. Individuals who have knowledge and skills useful to them should they desire advanced training in farm machinery and related fields.

3. Individuals who have knowledge and skills useful in becoming self-employed in farm machinery and equipment sales and service.

AREA II. FARM BUILDING AND STRUCTURES (CARPENTRY)

A. Scope of Instructional Content

Farm buildings and structures. Farmstead layout, functional requirements of buildings, drawing, plan reading, heating, ventilation, water supply, sewage disposal, farm fencing, service structures, selection and use of building materials.

B. Specific Activities to Be Performed to Develop Skills

1. Selecting and/or preparing a design for a building or project
2. Selecting a blueprint or preparing a drawing for a building or project
3. Reading and using working drawings and/or blueprints
4. Preparing a bill of material for a given design
5. Selecting materials indicated in a bill of material
6. Computing cost of materials in a given bill of material
7. Selecting the site for a given building
8. Laying out building foundation
9. Leveling and setting batter boards for a given building
10. Laying out and preparing footings
11. Constructing footings and/or foundation
12. Installing termite shields
13. Measuring, using squares, and marking rafters, steps, framing, sheathing, and other carpentry materials
14. Sawing with hand and/or power saws
15. Placing and "plumbing up" carpentry materials
16. Nailing and fastening carpentry materials
17. Applying sheathing and sub-flooring
18. Selecting kinds of paints, finishing, and preserving materials
19. Estimating amounts and costs of painting and finishing materials
20. Preparing surfaces for painting and finishing-- removing old finish, filling wood, sanding, etc.
21. Mixing paints, varnishes, shellac, stains, and other finishes
22. Tinting and coloring paint
23. Applying stains
24. Selecting brushes
25. Selecting type of fencing--barbed wire, netwire, electric, etc.
26. Selecting fence wire, and staples or other fasteners
27. Selecting type and size of posts
28. Preparing posts for treating
29. Treating posts
30. Laying out fence lines
31. Setting posts
32. Bracing posts--corner, line, end braces, etc.
33. Stringing and stretching wire
34. Fastening wire to posts
35. Erecting temporary fences
36. Building and connecting electric fences
37. Hanging gates
38. Constructing cattle guards, stiles, etc.
39. Cleaning and storing tools and materials

C. Tools and Equipment (Farm Buildings and Structures)

Axes	
Single bit	1
Double bit	1
Bars	
Crow and tamping -- combination 6 ft., homemade	2
Pinch -- 3 ft. and 4 ft. lengths, one each	2
Bits	
Auger -- 1/4" to 1" by 16ths, set	2
Countersink, rose	4
Expansive -- 7/8" to 3"	1
Ship Auger -- 1/2", 3/4", one each	2
Brace -- ratchet bit, 10" sweep	4
Caulking gun -- hand-type pressure	1
Chalk line -- retractable metal case	1
Chisels	
Cabinet -- shank running through handle, 1/4", 1/2", 3/4", 1", 1-1/4", set	2
Clamps	
Cabinetmaker's -- 5' bars	6
"C" -- 4", 6", 8", one each	3
Cutters, glass -- hand	4
Dividers, wing -- 8" or 10"	2
Drivers	
Screw -- standard, medium	4
Screw -- phillip	2
Spiral -- ratchet-automatic quick return (Stanley or equal)	1
Hammers	
Claw -- curved, 16 oz.	4
Claw -- straight, 16 oz.	2
Sledge -- 8 lbs.	1
Hatchet	
Broad -- 4-1/2" cutting edge	2
Shigling -- 4-1/2" cutting edge	2
Jointer	
6" -- complete with 3/4 hp, a-c 115/230-volt, 3,450 rpm motor with thermo-magnetic start and stop breaker switch (Delta, Power-matic or equal)	1
Knives, draw -- 10"	2

Level -- 24" carpenter's 1
Builder's -- terracing, with telescope (Bostrum, 3 screw leveling or 4 screw leveling) 1

Mallets -- wood or plastic 4

Mattock 1

Pinchers -- carpenter's 2

Planer
16" power -- complete with 5 hp, a-c single-phase or three-phase motor, rpm of motor 3,450, 115/230-volts, 55/27.5 amps, with stop and start thermo-magnetic breaker (Powermatic or equal) 1

Planes
Block -- adjustable 6" 4
Jack -- 14" 4
Jointer -- 22" 1

Pliers, wire cutting fencing 2

Post-hole digger 1

Protractor 1

Putty Knife 4

Rasps, cabinet -- 10" and 12", one each 2

Rules
Zig-zag -- 6 ft. 4

Sanders
Electric belt -- 115-volts, 60-cycle, belt size 3" x 24" complete with dust bag, nozzle, and vacuum system (Porter Cable or equal) 1
Disc -- heavy duty, complete with 3 assorted 7" sanding discs, 5" wire cup brush, 5" cup grinding wheel and backing pads. Universal motor 115-volts a-c, 60-cycle, speed 5,000 rpm. Spindle diameter 5/8" (Porter Cable, Skill or equal) 1

Saws, Power
Radial arm -- 14" complete with dado head, kickback attachment, and table. Three hp, a-c single-phase or three-phase motor, 115/230-volts, rpm of motor 3,425, with start and stop thermo-magnetic breaker (Dewalt or equal) 1

Tilting arbor -- 10" complete with start and stop thermo-magnetic breaker, 1 hp, a-c motor, speed 3,450 rpm, 115/230-volts, single-phase or three-phase, mitre gauge (Delta or equal) 1

Band -- 14" complete with mitre gauge, 3/4 hp, a-c, single-phase 115/230-volts, 1,740 rpm with start and stop thermo-magnetic breaker (Delta or equal) 1

Power hand -- 8" complete with motor, 7,000 rpm maximum speed, rip guide and metal carrying case. Heavy duty (Porter Cable, Skill or equal). 1

Saws, Hand
- Compass -- 12" or 14", one each 2
- Coping 2
- Cross cut -- 8 or 10 point, 26" (Diston or equal), two each 4
- Cross cut -- Two man 1
- Keyhole -- 10" 2

Rip -- 5 or 6 point, 26" (Diston or equal), one each 2

Saw horses -- wood, homemade 4

Scrapers, wood 4

Sets, nail -- assorted sizes 8

Shovel -- round point, long handle 2

Staple puller -- homemade 2

Squares
- Carpenter's steel -- 16" x 24", 1/16" markings 4
- Combination -- 12" try and mitre 2
- Sliding T Bevel -- 8" 1

Tape
- Steel -- 6 ft. 4
- Steel -- black and white face, 50 ft. 1

Vise -- woodworking, continuous screw, 4" x 10" jaws 6

Wire splicer -- hand 2

Wire stretchers 1

Figure 3 - A portion of a carpentry (farm buildings and structures) laboratory work area, showing band saw, radial arm saw, table saw, surfacer, and tool cabinet (see tool list on page 18). Note completed set of steps made by student.

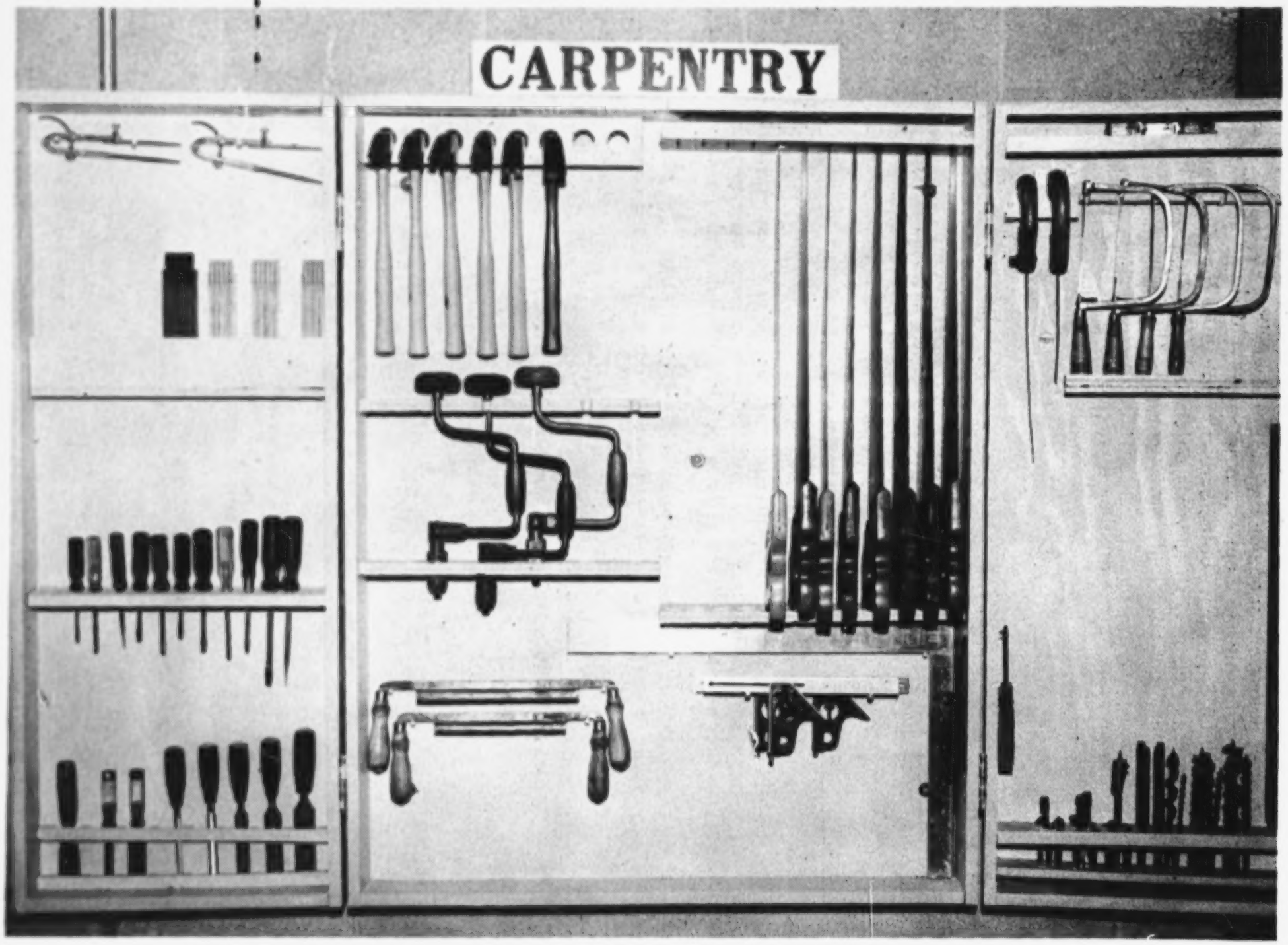


Figure 4 - Close-up of cabinet, showing arrangement of basic tools needed in carpentry work. Size of cabinet: length 48 inches, width 36 inches, depth 10 inches.

D. Materials and Supplies (Farm Buildings and Structures)

It is difficult to prepare a detailed comprehensive list for instruction in this area, due to the varied nature and scope of materials and supplies available. Sufficient amounts of these materials and supplies should be provided to give the skilled training needed: lumber, nails, bolts, screws, corrugated fasteners, glue, hinges, sprigs, lag screws, sandpaper, steel wool, paints, varnish, stains, shellac, oils, preservative thinner, roof coverings, wall coverings, floor coverings, etc.

Note: Due to a possible storage problem it may be more feasible to obtain these materials as needed

E. Outcomes

Primary outcome: An adequate supply of farm operators and farm workers who can construct, repair, and maintain the farm buildings and structures in connection with operating a modern farm.

Secondary Outcomes:

1. A supply of workers who have had basic training which is useful to them in entering the building and construction trades as semi-skilled, and in some cases skilled workers. These individuals may be employed as carpenter helpers, apprentice painters, workers in building supply firms, etc.

2. Individuals who have the knowledge of basic principles and skills beneficial in entering advanced training in the building and construction trades.

3. Individuals who have knowledge and skills useful in becoming self-employed in the building and construction business.

AREA III. ELECTRICITY

A. Scope of Instructional Content

Planning an adequate wiring system for the farmstead. Calculating present and future load demands; determining number of circuits, outlets, switches, etc. Installation of service entrance, distribution panel, circuits, outlets, switches, etc. Selection, use, operation and maintenance of electrical equipment. "Trouble shooting". Safety precautions.

B. Specific Activities to be Performed to Develop Skills

1. Selecting electrical materials -- kind, size, and type
2. Estimating quantities and determining cost of bills of material
3. Selecting tools -- kinds, type, and quantity
4. Stripping wire
5. Making various splices
6. Soldering and taping
7. Connecting wire in outlet boxes, junction boxes, and switches
8. Locating and installing service entrance and distribution panel
9. Locating and installing junction and outlet boxes
10. Locating and installing switches
11. Installing lighting circuits -- 110 volts
12. Installing convenience outlet circuits -- 110 volts
13. Installing major appliance outlets -- 220 volts
14. Installing solderless connectors, wire nuts, etc.
15. Locating and installing central distribution system
16. Waterproofing electrical connections
17. Installing grounding equipment and devices
18. Installing fuses and circuit breakers
19. Testing continuity of electrical system

C. Tools and Equipment (Electricity)

Bits, wood boring -- 1/2", 3/4", 1", one each 3

Bit brace -- 10" sweep 2

Blow torch or "Prep-to" LP gas burner 2

Coppers, soldering -- 1 1/2 lbs. 1

Drivers, screw -- standard, small to medium, assorted sizes 8

Electric soldering gun. 1

Hammer, claw 2

Hickey - conduit bender -- to handle 1/2" conduit (Thomas & Betts or equal) 1

Pliers
- Combination -- 8", slip joint 4
- Diagonal cutting -- 6", (Klein or equal) 2
- Lineman's, side cutting -- 8", (Klein or equal) 4
- Needle nose -- 6", (Klein or equal) 4

Ruler -- zig-zag, 6' 2

Screw starter with screw holder 1

Tape, steel -- 6' 2

Terminal connecting tool -- (Sta-Kon No. WT 111 M, manufactured by Thomas & Betts), complete with assortment of ring-tongue terminals, spade-tongue terminals, and two-way connectors, complete 1

Tester -- a-c volt-amp, combination voltmeter, ammeter continuity tester, amperes range scale 0 to 100-amps, voltage range scale 0 to 600-volts, complete with leads and leather case (Amprobe Junior Model No. 500, manufactured by Pyramid Instrument Corp. or equal) 1

Testing light -- for use in testing continuity of electrical circuit, homemade 1

Wrench, adjustable end -- 10" 1

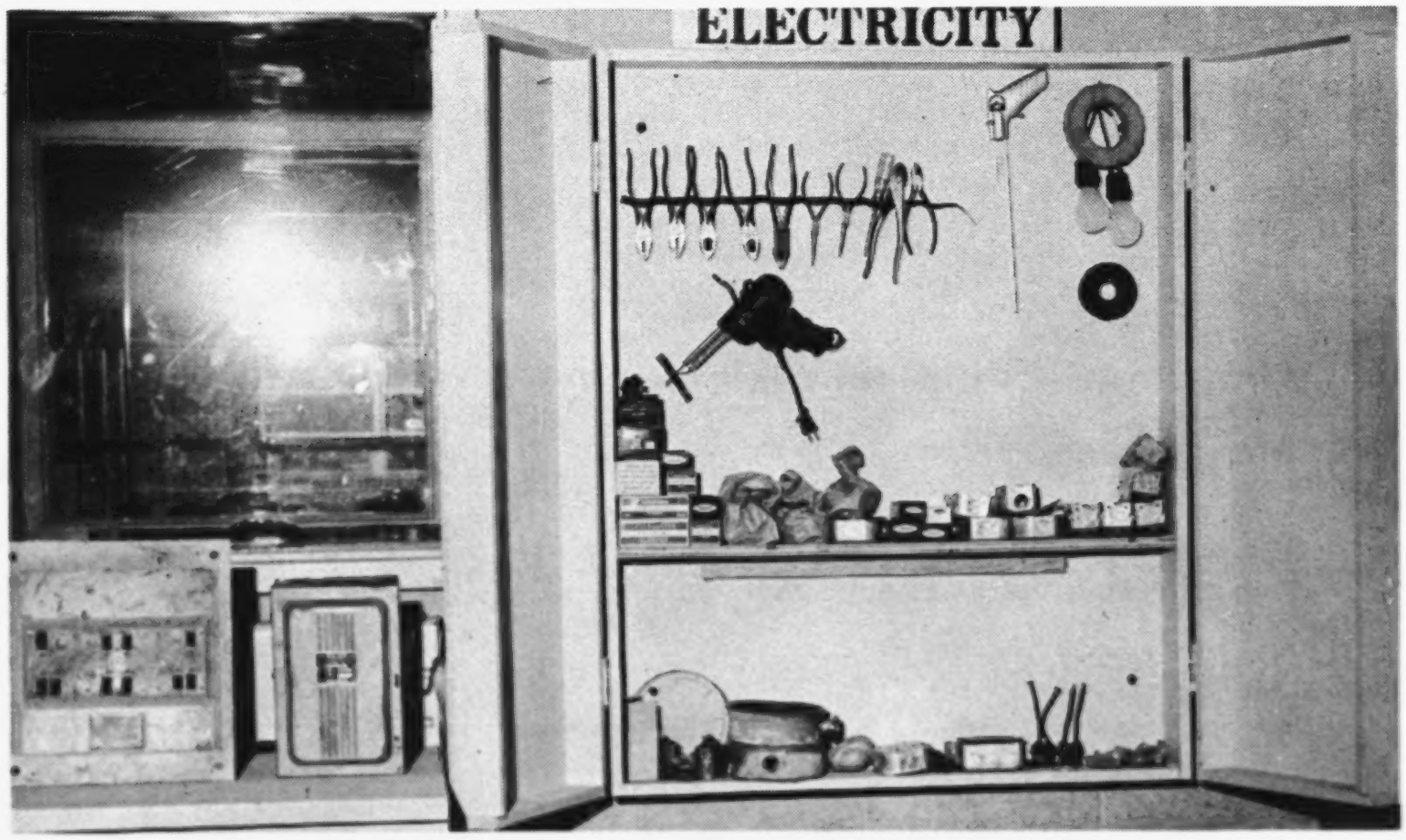


Figure 5 - A portion of electricity laboratory work area, showing cabinet and tool arrangement. The cabinet shown does not include a complete set of tools for this area (see complete tool list, page 21). Suggested cabinet size: length 48 inches, width 36 inches, depth 10 inches. Note: separate cabinet for supplies is desirable.

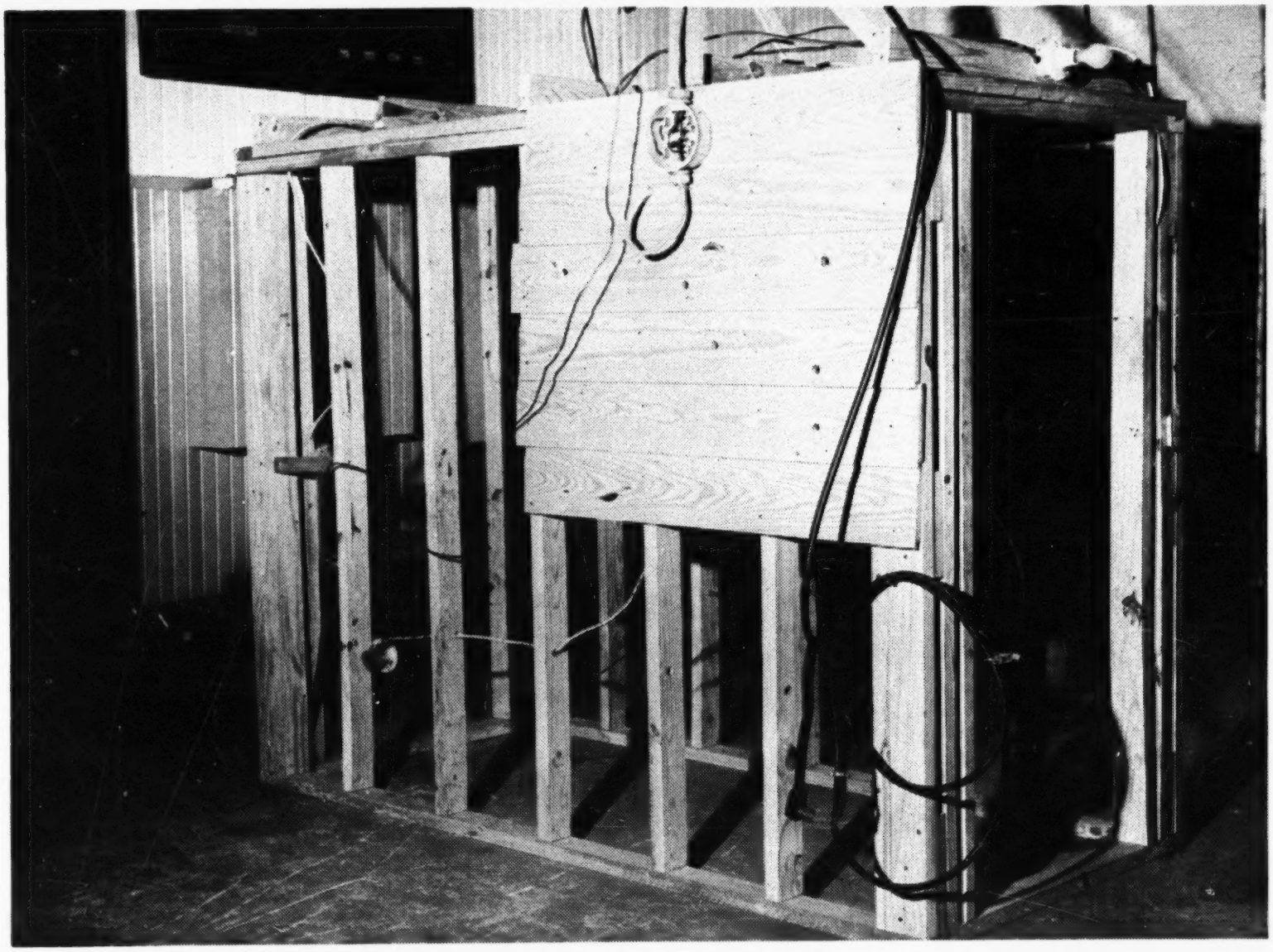


Figure 6 - Portion of electricity laboratory work area, showing framed building for practice wiring. Size of building shown: length 8 feet, width 4 ft., height 6 feet. Framing conforms to good carpentry standards and utilizes good materials. The set-up here is a 220v service.

D. Materials and Supplies (Electricity)

Boxes	
Switch or outlet	6
Junction	2
Breaker circuit -- 60-amps, 4 circuits with breakers	1
Cable	
Entrance #6-3	20 ft.
UF # 12-3	sample
Clamps	
Entrance cable -- for #6-3	3
Ground -- for 5/8" rod	1
Connector	
Meter base -- water tight 1"	2
Main entrance switch -- for #6-3 cable	3
Romex -- 1/2"	10
Solderless -- for #12-2 wire	50

Light, test -- 115/230 v, homemade	1
Meter base	1
Nuts, wire -- for #6 wire	6
Receptacles	
Duplex grounded	4
Range	1
Porcelain keyless	4
Duplex non-grounded	4
Solder resin core	1 lb.
Staples, romex	2 lbs.
Switches	
Main entrance -- 60-amps, with fuse	1
Single pole	4
3-way	4
Tape, electrical	2 rolls
Weatherhead -- for #6-3 entrance cable	1
Wire	
Ground -- #4, non-insulated	10 ft.
Romex -- #12-2	250 ft.
Romex -- #12-3	100 ft.

Lumber to construct laboratory building
(Dimensions of building -- length 8 ft., width 4 ft., height 6 ft.)

2" x 4" x 12' -- S4S, # 1 pine or equal	12 pcs.
2" x 4" x 8' -- S4S, # 1 pine or equal	12 pcs.
4' x 8' x 1/4" -- plywood, pine or equal	1 pc.
4' x 8' x 3/8" -- gypsum board	1 pc.
1" x 8" x 12' -- drop-siding	1 pc.

E. Outcomes

Primary outcome: An adequate supply of farm operators and farm workers who understand the basic principles of electricity and electric wiring; and who have enough skill training in electric wiring and electric motor maintenance to keep this phase of the modern mechanized farm functioning.

Secondary outcomes:

1. A supply of workers who have a knowledge of the basic principles of electricity, skills in electric wiring, and skills in electric motor maintenance which will be useful to them should they enter work in industries where such knowledge and skills are required.

2. Individuals who have basic knowledge and skills prerequisite to entering advanced training as electrical technicians.

3. Individuals who have knowledge and skills in becoming self-employed in electrical service businesses.

AREA IV. WELDING

A. Scope of Instructional Content

Economic value of welding, selection, installation, operation, and maintenance of welding equipment. Identifying kinds of metal and their characteristics. Kinds and sizes of electrodes, rods, welds, etc.

B. Specific Activities to Be Performed to Develop Skills

ARC

1. Identifying kind of metal to be welded
2. Determining type of welding to be done
3. Preparing surfaces to be welded
4. Selecting kind and size of electrode
5. Selecting and adjusting accessories
6. Adjusting amperage
7. Striking arc, running beads, and chipping
8. Welding in the flat position
9. Welding in the vertical position
10. Welding in the overhead position
11. Welding in the horizontal position
12. Welding cast iron
13. Welding high-carbon steel and other alloys
14. Welding pipe
15. Hardfacing
16. Cutting and piercing with electrodes
17. Heating with the carbon-arc torch
18. Brazing with the carbon-arc torch
19. Soldering and hardfacing with single carbons
20. Cleaning, servicing, and storing arc-welding equipment and supplies

OXY-ACETYLENE

1. Identifying kind of metal to be welded
2. Determining type of welding to be done
3. Preparing surfaces for welding
4. Selecting proper tip and/or other equipment
5. Attaching gauges to tanks and checking for leaks
6. Adjusting valves, gauges, and flame
7. Fuse-welding steel in the flat position
8. Fuse-welding steel in the vertical position
9. Welding cast iron
10. Brazing steel, cast iron, and other alloys
11. Silver soldering
12. Soft soldering

13. Cutting steel and cast iron
14. Hardfacing
15. Annealing and tempering
16. Cleaning, servicing, and storing gas-welding equipment

C. Tools and Equipment (Welding)

ARC

Arc welder -- 180/225 amps, a-c, or d-c, complete with leads, grounding clamp and carbon-arc torch (Lincoln or equal) 4

Brushes, wire -- hand, long handle 6

Clamps, "C" -- 4", 6", 8", two each 6

Gloves, welding -- long cuff, pairs 4

Hammer
- Ball peen -- 1 lb. 2
- Cross peen -- 2-1/2 lb., blacksmith 1
- Metal chipping 4

Helmets, welding 8

Pencils, metal marking soapstone -- complete with metal holder 4

Pliers, vise grip -- 8" 2

Squares
- Carpenter, steel -- 16" x 24" with 1/16" markings 1
- Combination -- 12" try & mitre 1
- Sliding "T" Bevel -- 8" 1

Tongs, straight-lipped -- 20" to 24" handle 2

OXY-ACETYLINE

Cart -- for tanks 1

Cleaner tip set -- assorted sizes 2

Gloves, welding -- long cuff, pairs 2

Goggles, welding & cutting -- pairs 6

Lighter, flint 2

Welding outfit -- complete with regulators, connectors, twin hose, cutting torch, and assorted welding tips (Purox, Smith or equal) 1

Figure 7 - A portion of a welding laboratory work area, showing arrangement of tables, welders, cabinet, and curtains. Curtains shown here made from "surplus property" material. Each station here is 6 feet x 6 feet (could be smaller) when cross curtains are drawn. Curtains should have clearance of 12 to 16 inches above floor. Water pipe of conduit may be used for curtain rods.

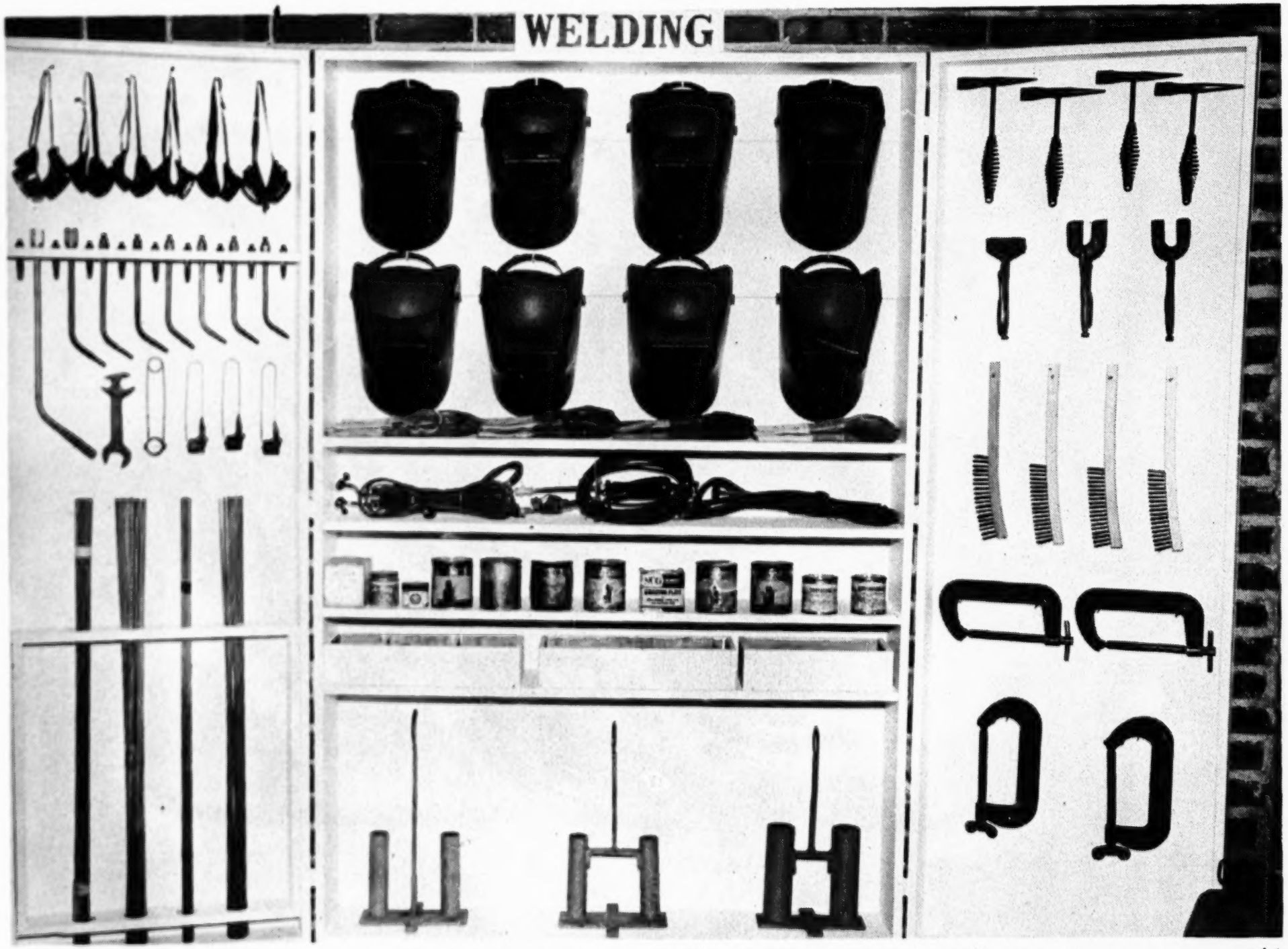


Figure 8 - Close-up of welding cabinet, showing arrangement of basic equipment and supplies used in arc and gas welding. Size of cabinet shown: length 72 inches, width 48 inches, depth 12 inches.

Figure 9 - Close-up of electrode storage made from discarded refrigerator. Use of 15w light bulb keeps electrode dry. Note substantial construction of racks.

D. Materials and Supplies (Welding)

ARC

Carbons	
5/32" plain, manual	6
3/16" copper, clad	6
Electrodes	
1/8" (FW 180)	100 lbs.
1/8" (Abrasoweld)	10 lbs.
1/8" (Ferroweld)	10 lbs.
Lenses	
Clear -- plastic	12
Colored -- no. 10 density	6
Powder, surface weld	1 lb.
Soapstone, marking	6 pcs.

OXY-ACETYLENE

Acetylene	1 tank
Flux	
Bronze	1 lb.
Silver solder	1/4 lb.
Lenses	
Clear	6
Colored	6
Oxygen	1 tank
Rods, welding	
3/32", 1/8", bronze -- 5 lbs. each	10 lbs.
3/32", 1/8", steel -- 5 lbs. each	10 lbs.
Solder, silver	2 oz.
Soapstone, marking	6 pcs.

E. Outcomes

Primary outcome: An adequate supply of farm operators and farm workers who understand the basic principles of arc and oxy-acetylene welding and who have welding skills sufficient to perform welding jobs involved in the construction and repairs needed in the operation of a modern farm.

Secondary outcomes:

1. A supply of workers who have had basic training in welding principles and skills which will be useful to them if they should desire to enter industry where such knowledge and skills are required. These individuals will be qualified to enter such industrial employment as semi-skilled welders and in some cases as skilled welders.

2. A supply of individuals who have a knowledge of basic principles and skills prerequisite to enter advanced training in welding.

3. A supply of individuals who have welding knowledge and skills useful in becoming self-employed in the welding business.

AREA V. CONCRETE AND MASONRY

A. Scope of Instructional Content

Functional requirements of materials, strength, suitability, durability, economy, drawing and blue print reading, structural design and layout, selection, design and use of concrete and masonry units. Laying out and construction of farmstead buildings

B. Specific Activities to Be Performed to Develop Skills

CONCRETE

1. Selecting and testing ingredients
2. Determining proper mixes
3. Computing amount of each ingredient needed for a given job
4. Constructing adequate footings
5. Designing, constructing, treating, and using forms
6. Screening and washing materials
7. Mixing
8. Selecting and using reinforcement materials
9. Placing concrete in forms
10. Finishing -- floating, troweling, etc.
11. Curing
12. Coloring

MASONRY

1. Selecting masonry materials -- kinds, types, and sizes
2. Estimating quantities and cost of materials
3. Laying out buildings
4. Mixing and preparing mortar
5. Applying mortar to blocks
6. Placing and setting blocks
7. Laying blocks at corners
8. Building wall between corners
9. Building around door and window frames
10. Building interior walls
11. Placing sills and lintels
12. Attaching sills and plates
13. Tooling mortar joints
14. Waterproofing
15. Curing mortar work
16. Painting

C. Tools and Equipment (Concrete and Masonry)

Blocks -- corner line holders 8

Buckets -- 10 and 12 qt., two each. 4

Chalk Line -- retractible, metal case	1
Drills	
Star -- 1/4", 3/8", 1/2", 5/8", 3/4", 1", one each	6
Masonry -- carbide-tipped, 1/4" to 3/4" set	1
Edger	
Square corner	1
Round corner	1
Float	
Steel -- 11 1/2" x 4 3/4" (Marshalltown or equal)	2
Wood -- homemade, 12", 14", 20", one each	3
Groover	1
Hoe, mortar	2
Jointing tool -- homemade	2
Level, masonry -- 48"	4
Mixer	
Portable, concrete -- capacity 3 1/2" cu. ft. drum, opening 17", height 41 1/2", speed 22 rpm, 3 mixing blades, 3/16" plate. Drum drive pinion gear to ring gear, 2.7 hp air-cooled engine, wheel size 4.00 x 12 pneumatic tires, suitable to be towed behind car or truck. (Jaeger Speed King or equal)	1
Ruler -- zig-zag, 6'	4
Shovels	
Concrete mixing -- square point, short handle	4
round point, short handle	2
Square, carpenter's -- 16" x 24"	2
Tape -- 50' steel	1
Trowels -- 11 1/2" to 12" x 5" (Marshalltown or W. Rose)	6
5" x 2 1/2" (Marshalltown or W. Rose)	1
16" x 4" cement finishing	1
Wheelbarrow -- medium size, steelbed, pneumatic tire	1

Figure 10 - A portion of a concrete and masonry laboratory work area showing mortar box, mortar board, tool cabinet, and partially constructed corners. Cabinet shown does not contain a complete set of tools needed in this area (see page 31 for tool list).

Figure 11 - Close-up of tool cabinet showing arrangement of basic tools used in concrete and masonry work (not complete). Size of cabinet: length 50 inches, width 36 inches, depth 10 inches (see tool list on page 31).

D. Materials and Supplies (Concrete and Masonry)

Aggregates	
Sand, concrete	1/2 yd.
Sand, masonry	1/2 yd.
Gravel, 1/4" to 3/4"	1 yd.
Blocks	
8" x 8" x 16", light weight, corner	75
8" x 8" x 8", light weight, half	12
Brushes, scrub -- fiber, 8 1/4" x 2 3/4"	4
Cement (Portland)	3 bags
Lime, hydrated	3 bags
Line	1 ball
Lye (Red Devil)	1 can
Vinegar (Heinz apple cider)	1 pt.

E. Outcomes

Primary outcome: An adequate supply of farm operators and farm workers who have a knowledge of the basic principles of concrete and concrete masonry; who have skills in using concrete for various jobs on a modern farm; and who have skills in using concrete blocks and other masonry materials in construction work which is necessary in keeping a farm modern.

Secondary outcomes:

1. A supply of workers who have training in the basic principles and skills involved in concrete and concrete masonry which will be useful to them should they enter off-farm occupations requiring such knowledge and skills. Many of these individuals, due to their supervised-work experience, can enter such employment as skilled workers.

2. Individuals who have knowledge and skills which will be useful to them should they desire to become self-employed in concrete and concrete masonry service businesses.

AREA VI. PLUMBING

A. Scope of Instructional Content

Planning a plumbing system, requirements of a complete plumbing and disposal system, identifying fixtures, fittings and accessories used in a plumbing system, location of fixtures and lines, assembling all pipes and fixtures for plumbing system, and maintaining the system.

B. Specific Activities to Be Performed to Develop Skills

1. Selecting water pipe, fittings, fixtures, and other plumbing supplies
2. Selecting pipe for other purposes
3. Determining amounts and cost of pipe and plumbing supplies
4. Reading and using blueprints and/or drawings in plumbing
5. Measuring, marking, and cutting pipe
6. Threading pipe
7. Reaming pipe
8. Applying sealer and assembling pipe and pipe fittings
9. Installing sink traps, floor drains, etc.
10. Cutting cast iron and other kinds of sewer pipe
11. Caulking, leading, and cementing joints
12. Laying out septic tank and/or lagoon
13. Installing septic tank
14. Laying out disposal field
15. Connecting sewer line to septic tank
16. Servicing septic tank
17. Servicing grease traps and other parts of the disposal system
18. Cleaning and storing plumbing tools and equipment

C. Tools and Equipment (Plumbing)

Bits
- Auger -- 1/2", 3/4", 1", one each 3
- Expansive -- 7/8" to 3" 1

Brace, ratchet bit -- 10" sweep 1

Brush, wire -- hand, long handle 2

Can, oil squirt 1

Chisel
- Wood -- 1/2", 1", one each 2
- Cold -- 1/2", 3/4", one each 2

Cutter
- Pipe -- 1/2" to 2" 1
- Tube -- 1/4" to 1" 1

Drill, star -- 1/4", 1/2", 3/4", one each	3
Driven	
Screw -- 1/4" x 4", 1/4" x 6", standard, one each	2
Screw, phillip -- medium	2
Furnace, plumber's -- gasoline	1
Hammer	
Ball peen -- 24 oz. head	2
Ball peen -- 12 oz. head	2
Irons	
Caulking -- right hand	2
Caulking -- left hand	2
Caulking -- straight	2
Caulking -- out-concave	2
Caulking -- in-concave	2
Yarning	2
Ladle, cast iron -- pouring	2
Level, carpenter's -- 24"	1
Pot, cast iron -- melting	1
Reamer pipe -- ratchet type, capacity 1/2" to 2-1/2", (Toledo Ratchet No. 380 or equal)	1
Ruler -- zig-zag, 6'	2
Runner, asbestos joint	2
Saws	
Hack -- adjustable frame	1
Hand -- 8 point, 26" (Disston or equal	1
Keyhole -- 10"	1
Shovel -- round pointed, long handle	1
Square	
Carpenter's -- 16" x 24"	1
Combination, try & mitre -- 12"	1
Tape, steel -- 6'	2
Threader, pipe -- ratchet type, die size 1/8" to 1-1/4" (Rigid or equal)	1
Torch	
Blow -- capacity 1 qt.	1
"Prep-to" LP gas burning	1
Wrenches	
Adjustable end -- 10", 12", 16", one each	3
Adjustable -- slip and lock nut	1
Basin	1
Pipe -- 12", 14", 18", two each	6

Vise, pipe -- 1/8" to 3-1/2", adjustable jaws 1

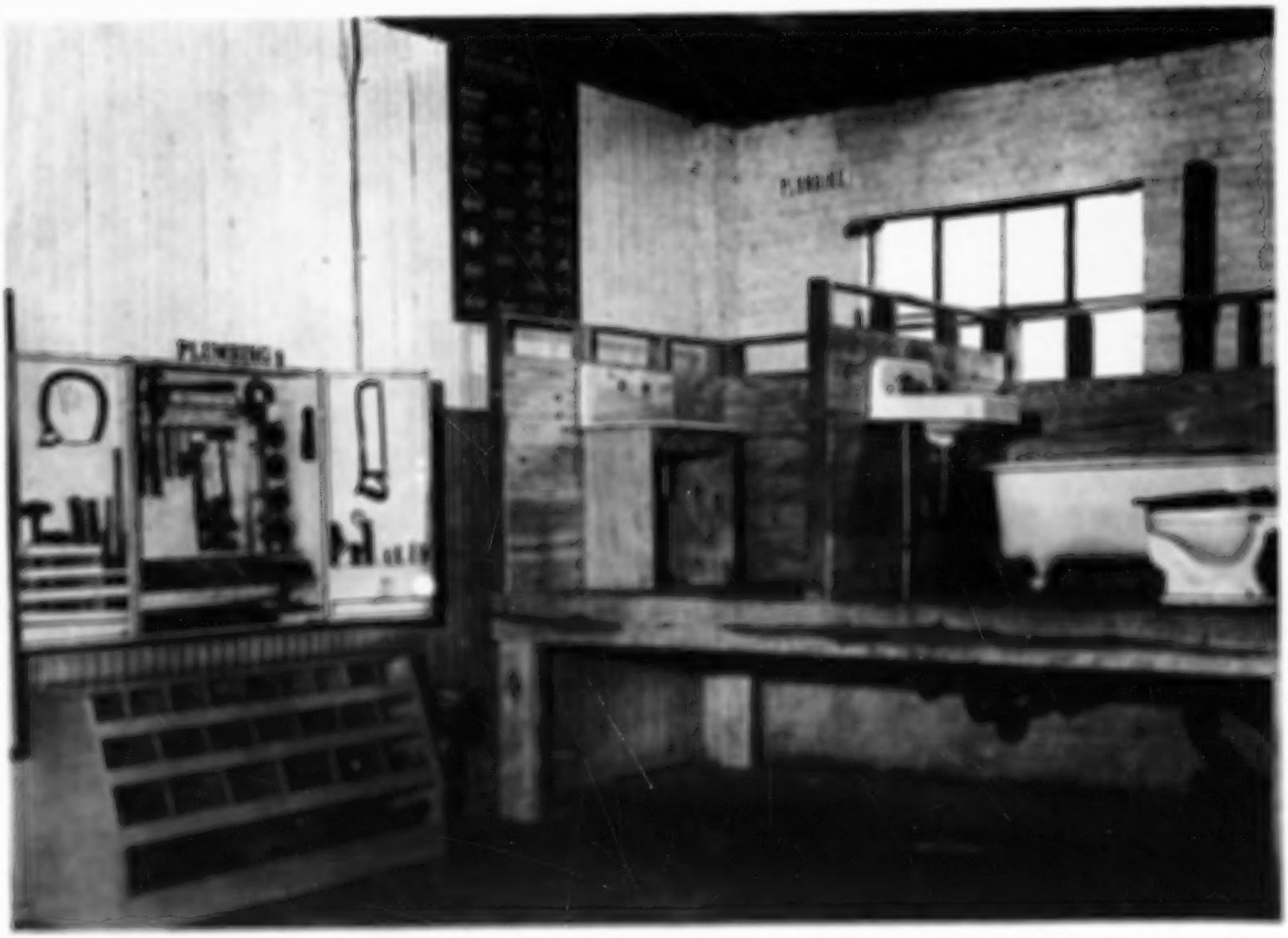


Figure 12 - A portion of plumbing laboratory work area, showing a simulated bath room and kitchen with some fixtures and disposal lines. Size of structure shown: width 6 feet, length 12 feet, floor height 32 inches, wall height 4 feet. Location of partition is determined by length of bath tub. Floor joists are 2" x 8", walls are of 1" x 6" "center match". Figure 13 shows more detail of tool cabinet and supply bin at left.

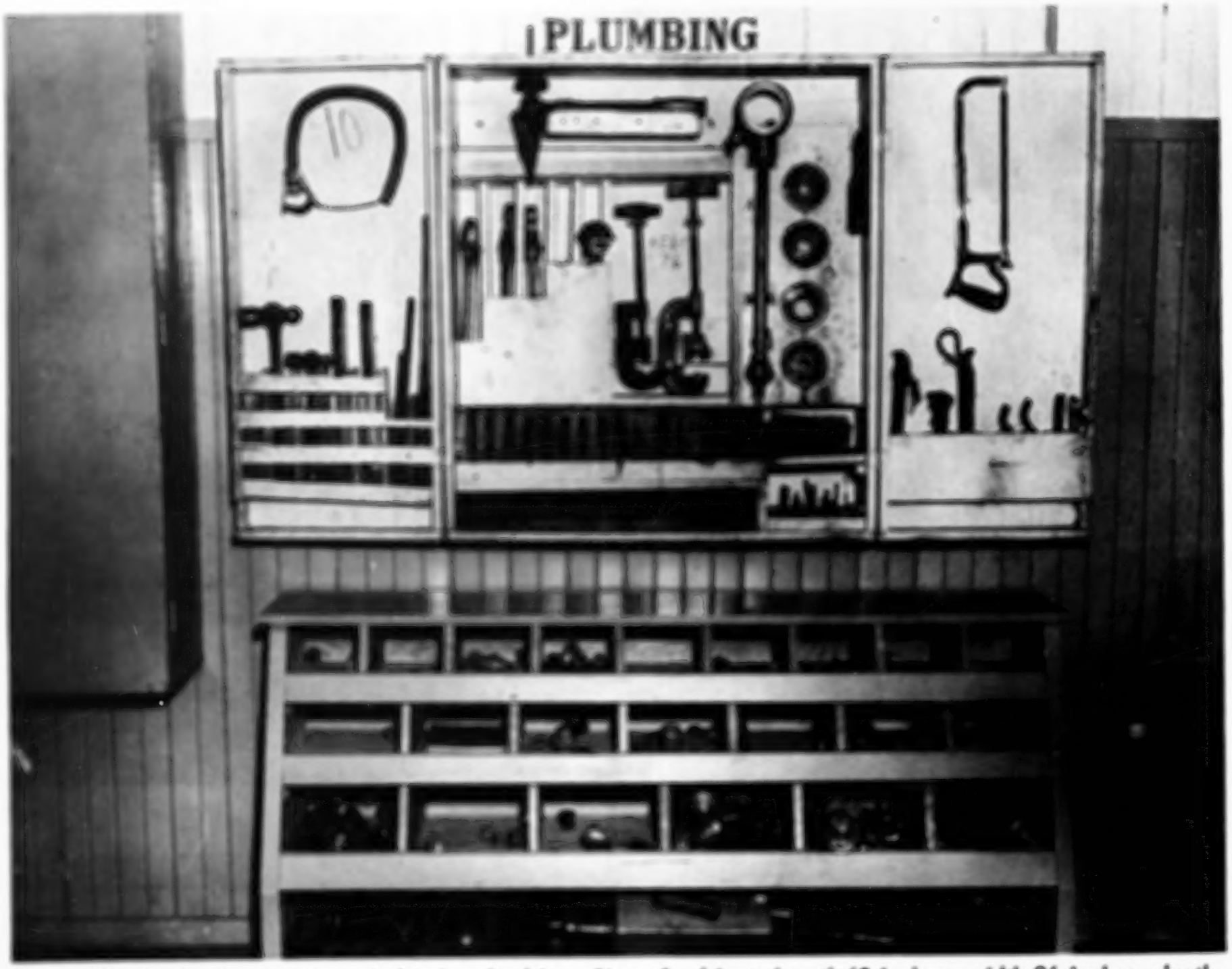


Figure 13 - Tool cabinet and supply bin for plumbing. Size of cabinet: length 48 inches, width 36 inches, depth 10 inches. This cabinet does not contain a complete set of plumbing tools (see tool list page 37). Size of supply bin: length 6 feet, height 32 inches, depth at top 12 inches, depth at bottom 18 inches.

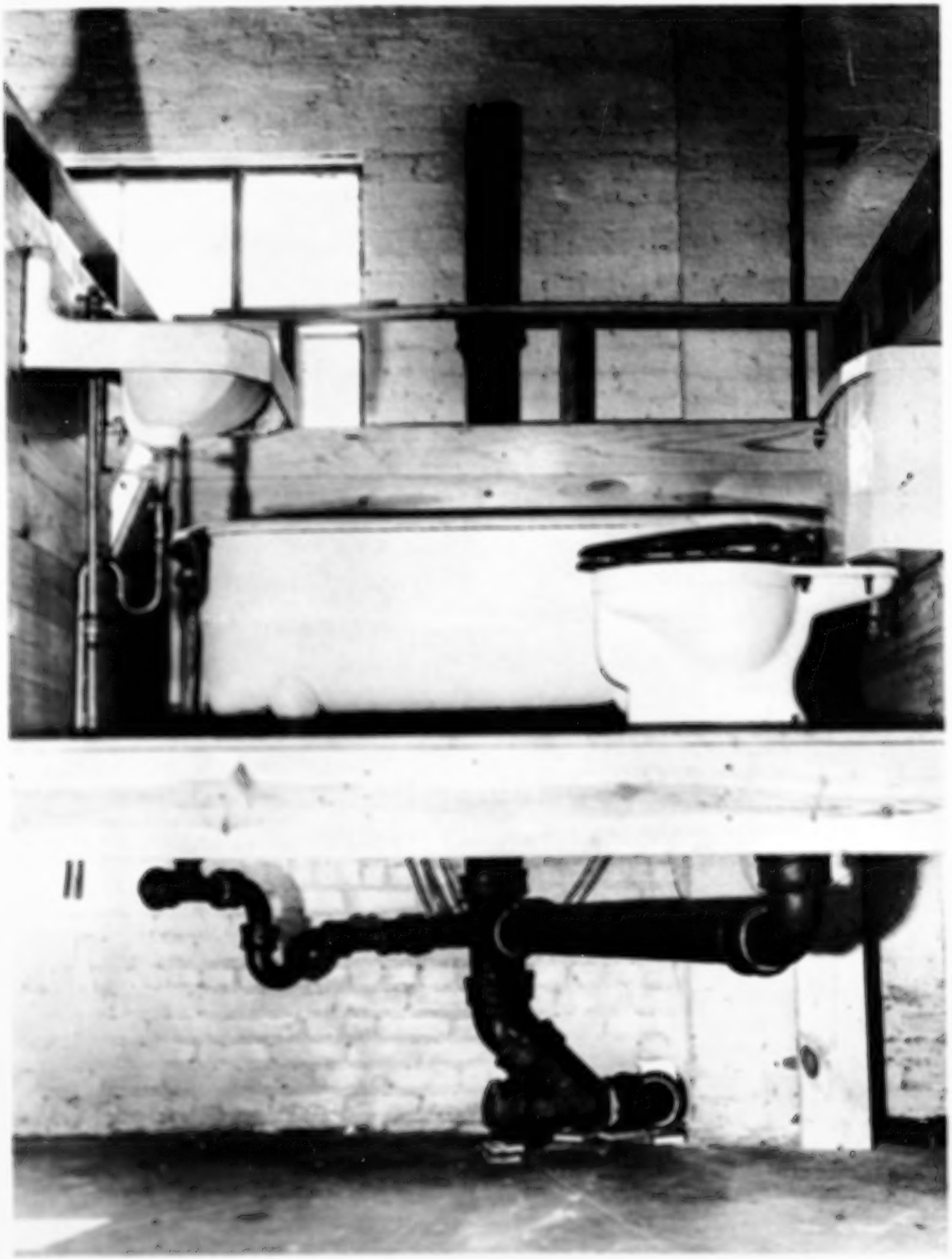


Figure 14 - Close-up of bath room fixtures, cast-iron disposal pipes, and leaded joints. Bath room floor is of sufficient height to allow work room underneath.

D. Materials and Supplies (Plumbing)

Bends, cast iron
- 1/8--4", 2", two each 4
- 1/4--4" , two each 4
- Combination "Y" and eighth 4" x 4", 2" x 2", two each 4

Branch, 2" x 2" "Y" 2

Collar, closet floor flange 1

Compound, pipe joint . . . . . 1 pt.

Ferrules, cleanout -- 2", 4", two each 4

Fitting, galvanized -- assortment of 1/2", 3/4", 1-1/4", 1-1/2", tubing, assortment 1/4" to 3/8" . . . . .

Fixtures
- Bath tub -- complete with fittings 1
- Kitchen sink -- complete with fittings 1
- Laboratory -- complete with fittings 1
- Toilet -- complete with fittings 1

Gasket, toilet bowl 2

Lead . . . . . 25 lbs.

Oakum . . . . . 20 lbs.

Oil, cutting . . . . . 1 gal.

Pipe, cast iron
- 2" -- single hub . . . . . 5 lengths
- 2" -- double hub . . . . . 2 lengths
- 4" -- single hub . . . . . 4 lengths
- 4" -- double hub . . . . . 2 lengths

Pipe, galvanized
- 1/2" . . . . . 2 lengths
- 3/4" . . . . . 1 length
- 1-1/4" . . . . . 10 ft.
- 1-1/2" . . . . . 10 ft.

Rags, wiping . . . . . 5 lbs.

Straps, pipe . . . . . 20 ft.

Tee's, cast iron
- 4" x 4" sanitary with 2" tapping, right and left, one each 2
- 4" x 4" with 1-1/2" tapping, right and left, one each 2

Traps
- 2" "P" 2
- 1-1/2" Drum -- tapping on one side and bottom 1

Tubing, copper -- 3/8" . . . . . 20 ft.

Lumber to construct plumbing building

(Dimensions of building -- length 12 ft., width 6 ft., height 4 ft.)

2" x 8" x 12' -- S4S, #1 pine or equal	7 pcs.
2" x 8" x 8' -- S4S, #1 pine or equal	4 pcs.
2" x 4" x 12' -- S4S, #1 pine or equal	12 pcs.
1" x 6" x 12' -- center-matched, #1 pine or equall	34 pcs.

E. Outcomes

Primary outcome: An adequate supply of farm operators and farm workers who can can plan, install, and maintain a water supply and disposal system for a modern farm.

Secondary outcomes:

1. A supply of workers who have had basic training which is useful to them in entering the plumbing trade as semi-skilled, and in some cases, skilled workers. These individuals, for the most part, may be employed as plumber's helpers.

2. Individuals who have knowledge and skills useful in becoming self-employed in the plumbing business.

AREA VII. METAL (HOT, COLD, SHEET)

A. Scope of Instructional Content

Selecting types, grades, shapes, sizes, determining characteristics, laying out designs, measuring, cutting, shaping, fastening, and painting.

B. Specific Activities to Be Performed to Develop Skill

1. Computing amounts and costs of materials
2. Laying out, marking, and cutting metal -- hacksawing, chiseling, etc.
3. Selecting hacksaw blades
4. Selecting files
5. Selecting drill and drill bits
6. Selecting taps and dies
7. Selecting punches and cold chisels
8. Selecting metal-working hammers
9. Selecting rivets, screws, bolts, and other cold-metal fasteners
10. Hacksawing
11. Filing
12. Drilling
13. Riveting
14. Threading and tapping
15. Bending and shaping
16. Finishing and treating
17. Annealing
18. Tempering

C. Tools and Equipment (Metal)

HOT

Anvil

Blacksmith -- solid one piece of genuine Swedish steel, weight 150 pounds. 1

Chisels

Hot -- 1 1/4", 1 1/2" blacksmith's with handle, one each 2

Forge

30" x 36" x 6" manually operated 12" fan, crank to turn either way. Ball bearings, high speed special gearing with bronze bearing, special gear and tool steel spiral shaft. Whirlwind blast, anti-clinker, heavy nest tuyere iron. Complete piping included.
(Champion #400 or equal) 1

Hammer

Cross peen -- 2 1/2 lbs., blacksmith 2
Ball peen -- 1 lb. and 2 lbs., one each. 2

Sledge hammer -- 8 lbs.	1
Hardy -- to fit anvil	2
Punches, blacksmith's round -- with handles 1/4", 3/8", 1/2", one each.	3
Tongs	
Bolt, blacksmith -- 3/8", 1/2", 3/4", handle length 20" to 24", one each.	3
Straight lipped -- 20" to 24", long handle.	2
Vise, blacksmith's -- 50 to 100 lbs.	1

COLD

Bits	
High speed -- 1/16" to 1/2" by 32nds., set	2
Twist -- 5/8", 3/4", 7/8", 1" with 1/2" shank, two each	8
Chisels	
Cold - 3/8", 1/2", 3/4", 1", one each	4
Cold, blacksmith's -- handle width at eye 1 1/2"	1
Cutters, bolt -- handle length 30"	1
Drills	
Power, portable hand -- 1/2", heavy duty.	1
Power, portable hand -- 1/4"	1
Drill press, floor model -- 15", 1/2 hp, a-c single-phase 115/230-volt electric motor, complete with start and stop switch, thermo-magnetic breaker (Delta or equal).	1
Grinder, power -- bench type, 8" wheel size (Stanley or equal).	1
Hammers	
Cross peen -- 2 lb. blacksmith	1
Ball peen -- 2 lb.	1
Oiler, squirt	1
Plate, screw -- NC 1/4" to 3/4" by 16ths, set (Little Giant or equal)	1
Punches	
Aligning -- points 3/16", 1/4", 3/8", one each	3
Center, machinist's -- diameter at top of tapered point 1/8" and 7/32", one each	2
Pin, machinist's -- 3/32", 1/8", 5/32", 3/16", 7/32", 9/32", one each	6
Starter	1
Saws, hack -- adjustable frame	2

Vises
- Machinist's -- 4" jaws, heavy duty 1
- Machinist's -- 6" jaws, heavy duty 1

SHEET

Coppers
- Soldering -- 1 1/2 lbs. 1
- Soldering -- 3 lbs. 1
- Electric soldering iron 1

Groover, hand -- 1/4", 3/8", one each 2

Hammer, tinners -- medium 2

Pliers
- Combination, side cutting -- 8" 1
- Diagonal cutting -- 8" 1

Snips
- Tinners, combination -- 12" length 2
- Tinners, duck bill type 2
- Tinners, left hand 1
- Tinners, right hand 1

Torch
- Blow, gasoline -- capacity one qt. 1
- "Prep-to" LP gas burning 1

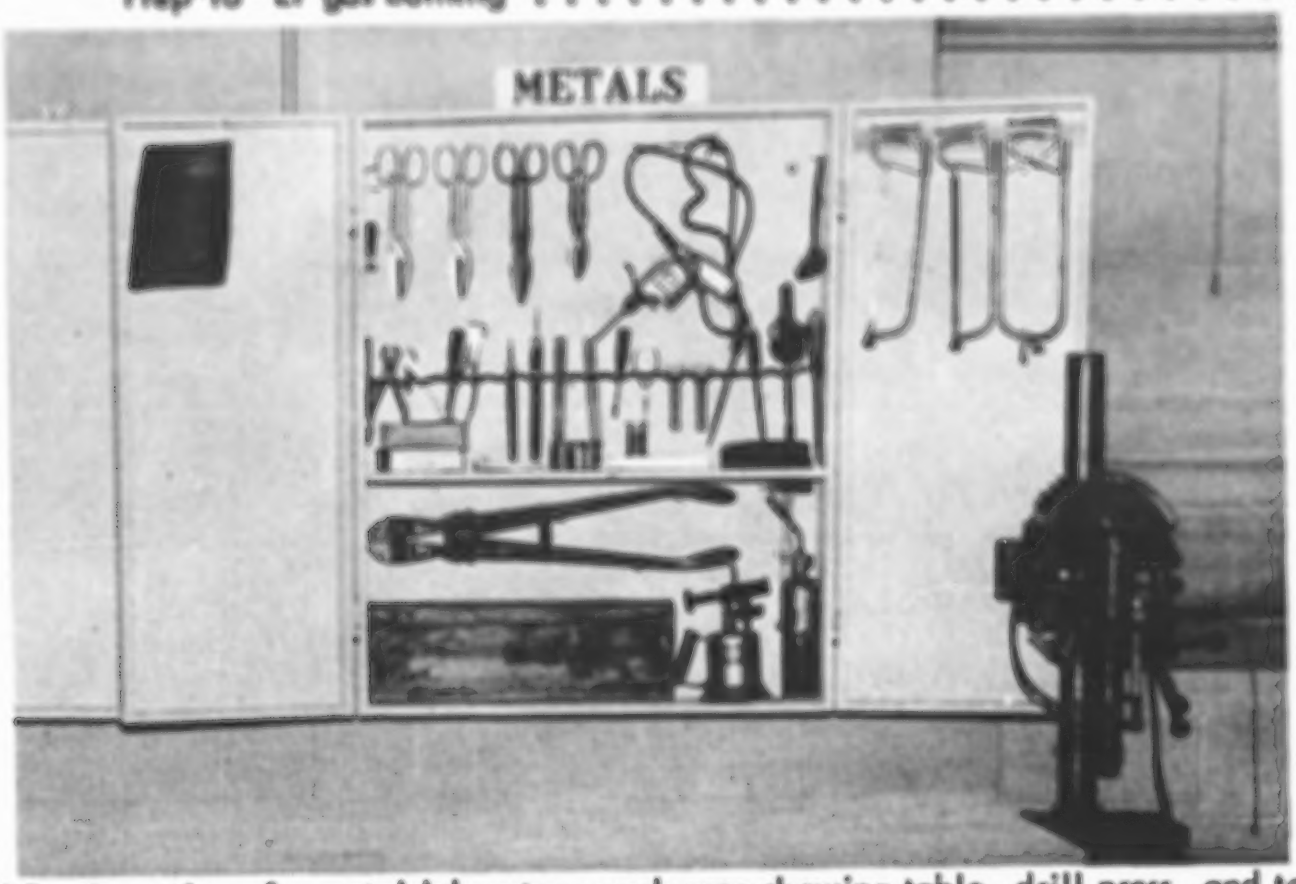


Figure 15 - A portion of a metal laboratory work area showing table, drill press, and tool cabinet. This cabinet does not contain a complete set of metal-working tools (see tool list, page 45). Size of cabinet: length 48 inches, width 36 inches, depth 10 inches. Not shown here are sheet metal clamps, vises, anvil, and other items essential for metal work.

D. Materials and Supplies (Metal)

It is difficult to prepare a detailed comprehensive list for instruction in this area, due to the varied nature and scope of materials and supplies available. Sufficient amounts of these should be provided to give the skilled training needed. Various metals such as: flat, sheet, angle, channel, round; solder, cleaning agents, rivets, bolts, screws,, wiping rags, oils, gasoline, coal, files, paints, etc.

E. Outcomes

Primary outcome: An adequate supply of farm operators and farm workers who understand the characteristics of metals and their uses on the modern farm; who have skills in cutting, shaping, and treating metal for various farm uses; and who understand the economics of using metal for certain farm jobs.

Secondary outcomes:

1. A supply of workers who have a knowledge of metals and basic skills in cutting, bending, and testing metals which are useful industries where such knowledge and skills are required. These individuals will have enough knowledge and skills to enter such industries as semi-skilled workers.

2. A supply of individuals who have the basic training for entering advanced training courses in the metal trades.

3. Certain individuals who have sufficient knowledge and skills to become self-employed in operating metal work shops.

AREA VIII. TOOL FITTING

A. Scope of Instructional Content

Cleaning, adjusting, repairing, sharpening, and maintenance of various tools used on the farm and in the vocational agriculture farm mechanics shop.

B. Specific Activities to Be Performed to Develop Skills

1. Selecting tool fitting equipment
2. Selecting tool fitting supplies
3. Filing and fitting saws
4. Sharpening edge tools -- chisels, plane irons, etc.
5. Grinding drill bits
6. Sharpening wood bits
7. Dressing and truing grinder wheels
8. Conditioning sharpening stones -- oil types and others
9. Fitting and installing tool handles
10. Adjusting tools for various operations
11. Conditioning and storing tools

C. Tools and Equipment (Tool Fitting)

Brushes
- File cleaner 2
- Wire wheel -- 8", electric driven. 1
- Wire, hand -- long handle 2

Cans, oil. 1

Dresser, Emery wheel. 1

Drivers, screw -- medium, standard 1

File 2

Goggles, grinding -- pairs. 2

Grinder, power -- bench type, 8" wheel size, complete with 1 fine and 1 coarse rock, tool rest shields, lights, etc. (Stanley or equal) 1

Grinder, tool -- wet, rock size 1 1/2" x 8", complete with motor 1

Jointer, hand saw 1

Saw, hack -- adjustable frame. 1

Saw set
- Hand, crosscut -- rip, piston grip 1
- Crosscut, 2 man 1

Squares
- Combination -- try & mitre, 12" 1
- Sliding T-Bevel -- 8" 1

Stones, oil -- combination. 2

Vises, crosscut -- hand saw, homemade 1

Vise, machinists -- 3", light weight. 1

Wrench, adjustable -- 10". 1

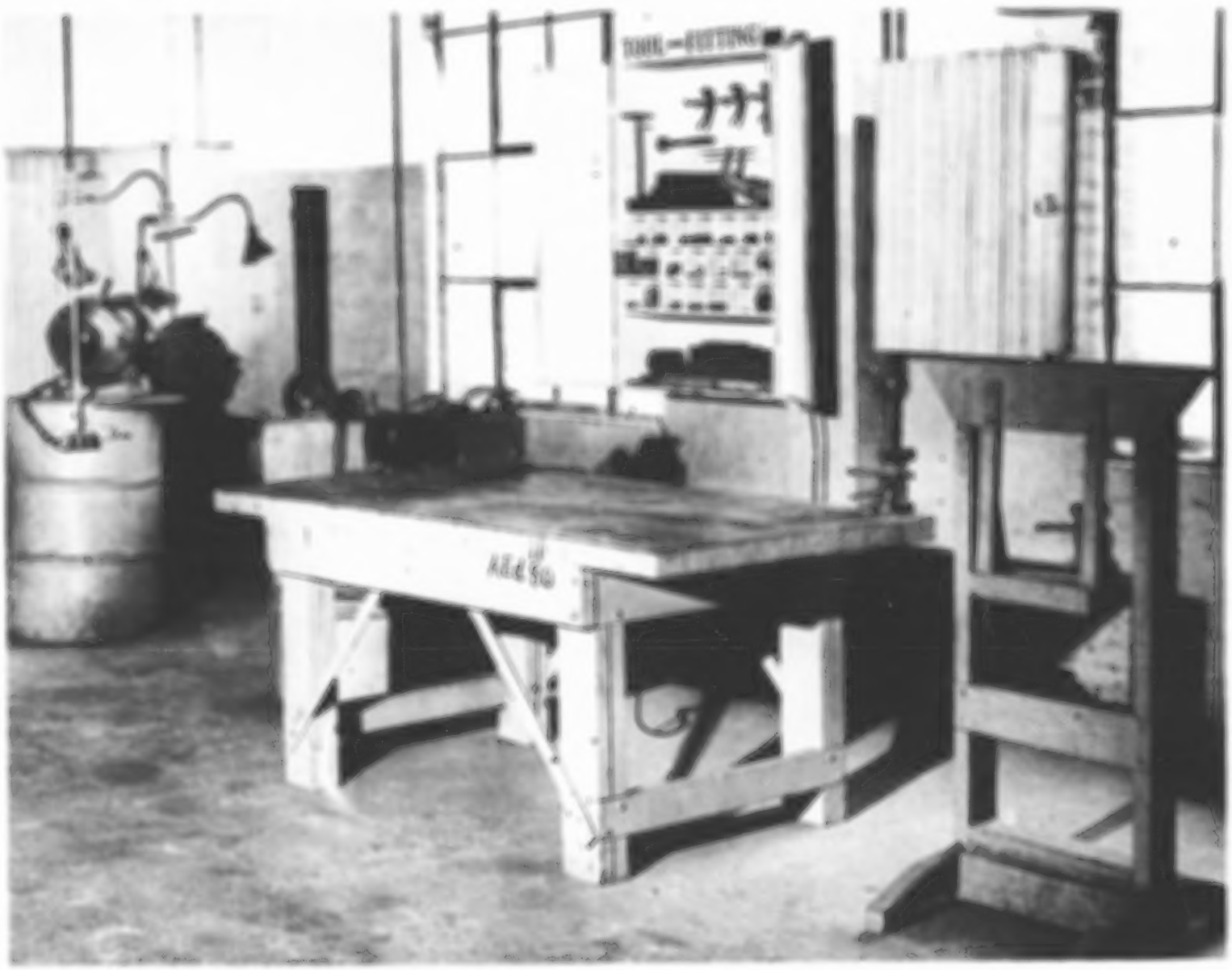


Figure 16 - A portion of tool fitting laboratory work area, showing in the background arrangement of tools in cabinet. The cabinet in this picture does not contain a complete set of tools for this area. (See complete tool list page 49.) Note, also, pigeon holes for small items. Suggested size for this cabinet: length 48 inches, width 36 inches, depth 10 inches. The picture also includes a grinder, buffer, and wet grinder.

D. Materials and Supplies (Tool Fitting)

Blanks, saw filing 12

Cloth, emery -- very fine . . . . . 6 sheets

Files
- Flat -- 10", 12", six each 12
- Mill -- 8", 10", six each 12
- Mill -- round edges, 8" 4
- Slim taper -- 6", 8", six each 12
- Extra slim taper -- 6", 8", six each 12
- Auger bit -- 7" 6
- Crosscut -- 8" 6

Handles
- File -- adjustable 6
- Hammer -- assorted 12

Oil
- Light weight . . . . . 1 qt.
- Penetrating . . . . . 1 pt.

Rags, wiping . . . . . 2 lbs.

Wedges, metal -- assorted sizes 24

Wool, steel -- one . . . . . 1/4 lb.

Wheels, emery -- fine and medium, one each 2

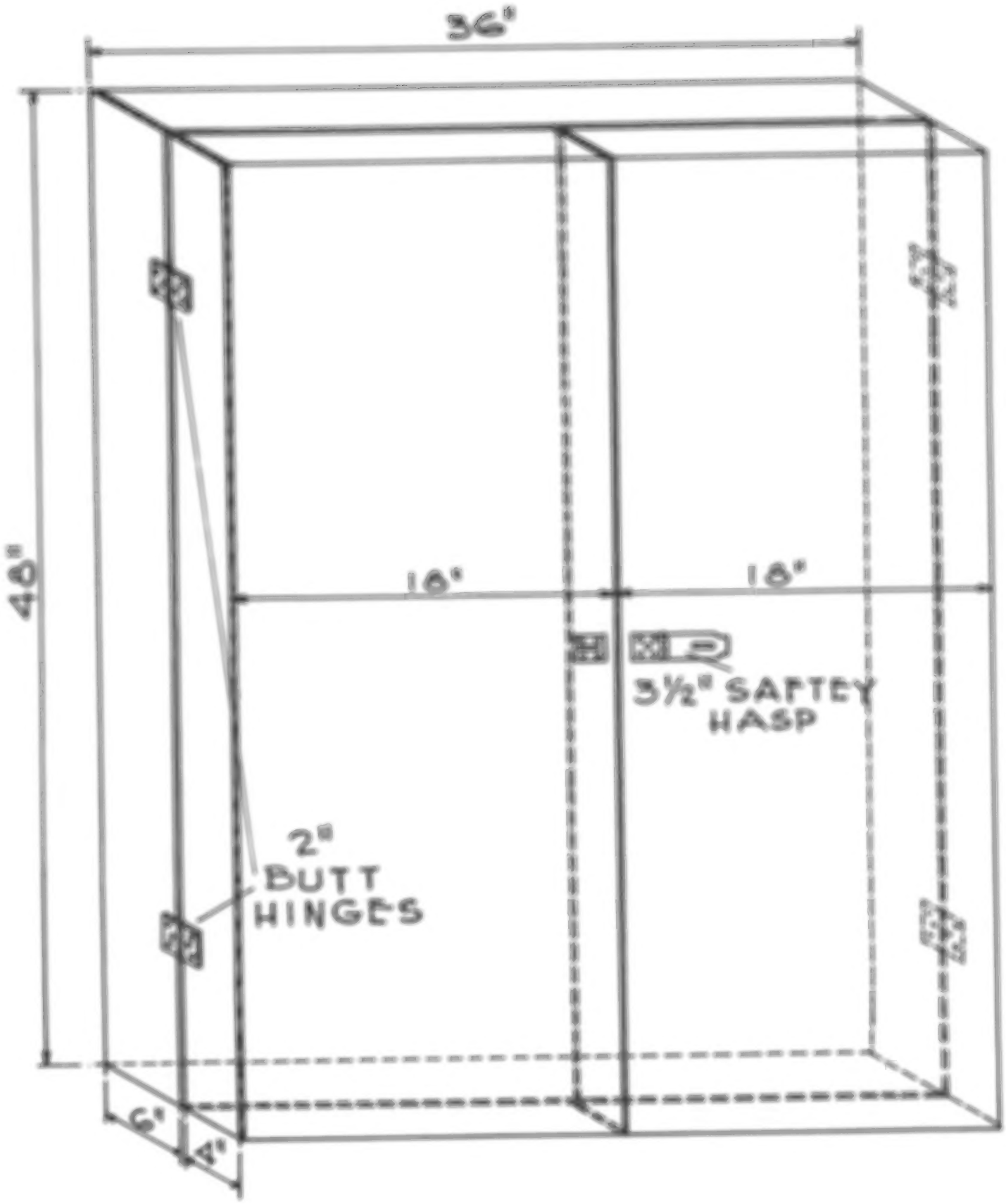
E. Outcomes

Primary outcome: An adequate supply of farm operators and farm workers who have a knowledge of basic principles and skills in fitting a wide variety of tools used on a modern farm.

Secondary outcomes:

1. A supply of workers who have had instruction in the basic principles of too fitting and who have skills in fitting a variety of tools which will be useful in entering off-farm occupations where such knowledge and skills are required.

2. Individuals who have knowledge and skills useful to them should they desire to become self-employed in a tool fitting service or business.



Bill of Material for Cabinet Shown Above

1 piece 1" x 4" x 8' -- S4S, #1 pine or fir
1 piece 1" x 10" x 14' -- S4S, #1 pine or fir
1 piece 1/2" x 4' x 8' plywood, finish both sides
4 steel butt hinges, 2" x 2"
1 hinge hasp and staple, 6"
40 No. 8 x 1-1/4" wood screws, flat head
24 No. 8 x 3/4" wood screws, flat head
9 No. 8 x 1/2" wood screws, flat head

Each shop should have six cabinets of the size shown in Figure 17. Adjustments will have to be made in the bill of material for concrete-masonry, and welding cabinets. See Figure 11 for concrete-masonry cabinet dimensions, and Figure 8 for welding cabinet dimensions.